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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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ERRATA.

Page 83, line 4 from top, *for Scotsman read* Scotsman.
,, 100, ,, 23 from top, *for* Severdrup *read* Sverdrup.
,, 137, ,, 2 from top, *for* Yates *read* Yate.
,, 319, ,, 24 from top, *for* Keptu *read* Keptul.
,, 395, ,, 2 from top, *for* east-by-south *read* east-by-north.
,, ,, ,, 11 from bottom, *for* north-west to south-east *read* north-east to south-west.
,, 410, ,, 8 from top, *for* Prof. Hull *read* Prof. Judd.
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THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ACROSS THE ELBURZ MOUNTAINS TO THE CASPIAN SEA.

By Lieut.-Colonel H. L. Wells, C.I.E., R.E., F.R.G.S., Corr. Member.

The expedition, a description of which is given in the following paper, was undertaken in September 1896, with a view to exploring the country north of Baladeh, and between that place and the Caspian, as a continuation of the sketch made by Lieut.-Colonel, now Major-General, Beresford Lovett, C.S.I., which, with his map, is given in the *Proceedings* of the Royal Geographical Society, No. 11, February 1883.

It was then thought that this bit of country had not been previously sketched. A sketch was made for which the scale 1 : 100,000 was chosen, so that it might be easily reduced, and the country added on, if necessary, to Colonel Lovett's map, which is on a scale of 1 : 500,000. Shortly after it had been made, a copy of a pamphlet and map entitled *Reisen in Nord- und Zentral- Persien*, by A. F. Stahl, published in supplement No. 118 to *Petermanns Mitteilungen* on 31st August 1896, reached Teheran, which showed that the country had already been surveyed. However, as the scale of the last-named map is small, and no description of the country or its population accompanies it, it is thought that the matter now given may still be of interest.

From what was seen by the writer, both during the trip now described and during one made in 1895, an account of which is published in the *Geographical Journal* for November 1896, it is judged that the mountain ranges between the watershed of the Elburz and the Caspian, like those on the southern side of the main range of that system, have almost invariably an outcrop running east and west, and are cut at right angles by the watercourses which have eroded deep gorges or cañons through them, so that the maps hitherto published give

a wrong impression, at all events of the lower slopes of the Elburz range towards the north.

The shortest route from Teheran to the Caspian is *viâ* the Afcha pass to the Lar valley, and thence by the Yalu or Ab-i-Safid pass out of the Lar valley to that of the river Nur; then out of the Nur valley by a third pass over the Kuh-i-Kuruk into the Kujur valley, and by the course of the stream which drains the last-named down to the sea, by which means the latter can be reached in three days, or two forced marches by a traveller without a change of horses. This was the route followed.

This route is said to be closed for five months in the year; and so any one wishing to come to the "Capital" from Kujur in the interval between November and March must descend to the sea, skirt its shores to Barfarush, and thence come *viâ* the town of Demavend, a journey of fourteen days. The Afcha pass is that over the watershed dividing the central plateau of Persia from the basin of the Caspian, and probably has an altitude of 9866 feet above the sea.

The valley of the Lar, with its trout-fishing, has been described in Baker's *Clouds in the East* and in Stack's *Six Months in Persia*.[1] In the latter book the road from Teheran to Lar *viâ* the Afcha pass is also described; the altitude of the latter is, however, wrongly stated as 13,000 feet, and the Gerdaneh Hazar Cham, which Stack mentions, is far away on another road to the Caspian (vide *Geographical Journal* for November 1896). A sketch of this portion of the road, viz., the Afcha, is shown on the map which accompanies General Schindler's paper, *Eastern Persian Irak*, published by the Royal Geographical Society in 1896.

No one seems to have noticed the ruins of a small fortress or castle which commands the pass out of the Lar valley near Verdegar (*vide* General Schindler's map), or the remains of a stone rampart which undoubtedly formed a barrier right across the valley at Chesma Shahi, which place is shown on Lovett's map.

The road from Lar to Baladeh, on the Nur river, is shortly described by Colonel Beresford Lovett in the periodical already referred to, and a map of the road is therein given by him.

At the Yalu gorge the Nur cuts at right angles through an enormous mass of basalt, forming a rocky defile very remarkable for its gloomy grandeur and dark colouring, so markedly in contrast with the snow-white precipices of gypsum which rise on either side of the valley at the village of Yalu. The valley is ruggedly picturesque the whole way down to Baladeh, and the river contains trout that took our flies.

At Baladeh, the Nur, passing through a defile, turns sharply east to join the Lar river at Panjab; and the route for Kujur and the Caspian quits it here, going westward under the walls of a ruined castle. The track follows a terribly strong watercourse, the steepness and roughness of which is testified by the number of dead mules lying in it. In September, the month we visited Kujur, great numbers of these animals

[1] *Six Months in Persia*, by E. Stack. Sampson Low and Co.

are employed in bringing charcoal from the mountains of Northern Mazanderan to Teheran.

A climb of one and a half hours from Baladeh brought us to the watershed that divides the ancient principalities of Nur and Kujur, known as the Kuh-i-Kuruk. The views thence looking north as well as south were very magnificent. In the latter direction the mountain ranges are rugged and grand, formed of basaltic and other volcanic formations, leading the eye up to the superb cone of Mount Demavend, which looks as fine from this side as when viewed from the south.

Looking north, the mountains were seen to be capped with forest or scrub and clothed with verdure. The basalt is replaced by greyish-blue limestone, the whole aspect being a very refreshing contrast to the brown desolation at our backs. The low-lying cloud-banks stealing up from the Caspian, and penetrating into the valleys, cut out the far distance, but still are a welcome harbinger of coolness and moisture.

The north slope of the Kuh-i-Kuruk has cowslips and gentians dotted about; the south is bare, save for thistles and coarse herbs. It was just at the summit of this watershed, on our return journey, that we were attracted by the quaint whistle of Snow-cocks, *Tetraogallus Caspius*, and marked down a covey of eleven; after an exciting stalk, a young cock, weighing six lbs., was bagged. Whilst looking about for the rest, we added a hare and a *chukar*, or red-legged partridge, to the bag. A zigzag road leads from the summit to the Kujur valley, with a steep precipice of grey limestone on the right. At the foot of this mountain is the village of Varasun, where we halted, and were hospitably welcomed by the Ked Khoda (=headman), Ismail Khan. This man boasted that he and the inhabitants of Varasun were descendants of Turks, and that their forefathers had been brought by Fath Ali Shah from Turbet-i-Sheikhjam; but for what purpose, whether to keep them out of mischief or to establish order amongst the existing inhabitants of Kujur, did not transpire. The men were a fine, hardy race. The women were for ever quarrelling and yelling at each other from their flat house-tops. The stream that runs through the village is bordered with large hazel bushes. Primroses and ferns abound.

The headman sent out *shikaris* in all directions to watch for bears for us, but none was to be found during the whole of our stay in Kujur. We were after pig one day; the whole of the able-bodied men of the village turned out as beaters, accompanied by their dogs, a large, fierce, wiry breed, very much resembling the boar-hounds in Snyders' pictures. The climbing about these hillsides and through the scrub was anything but easy. Whilst waiting on a rock for a drive, we were passed by a herd of hill cattle accompanied by a beautiful stag of the Maral breed, which had been brought as a fawn from the jungles to the north, and has become domesticated. It certainly was a beautiful beast, its antlers resembling those of the red deer, but its coat somewhat greyer than the latter's; its rump and the inner sides of its hind legs were fawn-coloured. A beautiful white mark ran on the outside of this colouring, looking like a sort of piping or ornamental line, and was prolonged down the hind legs of the animal.

The pariah pack at length caught a full-grown sow, and the excitement the villagers evinced was amazing; the noise that was going on as we ran up led us to believe that some one was in dire straits, and that we might be charged at any moment by a furious boar; but the dogs had the poor pig tight by the ears and throat, and there was nothing for it but to despatch her. Without leashes or means to hold them the lurchers would never have allowed the animal to escape, even had they been beaten off. On our way back we fell in with several large coveys of partridge, *Perdix barbata*, very much resembling the English bird in plumage, and exactly similar to it in flight; one of these was bagged. A second time we explored the hill to the north-east of Varasun, but would have no more of pig, as the sport seemed extremely tame. We bagged a brace of pheasants, a hare, and a quail, and came across a quaint dairy, or *gav sarai*, the property of a certain Habib Allah Khan, and the home of the herd and the stag we had seen the day before.

We emerged out of the mist and jungle into a clearing divided up into paddocks with hedges of thorns, in the centre of which was a large shed or hut, half excavated out of the hillside, and so low that it was necessary to stoop to enter it. Inside it was tolerably commodious, though the roof of branches and brushwood would evidently only turn the worst of any wet that might fall on it. The hut was divided into two compartments—one apparently for the dairy produce, the other for the dwelling-place of the dairy-men, who, to the number of eight or ten, were either squatting, smoking, inside, or lounging outside the doorway of the hut. A pleasant-faced, brawny bearded lot they were; all dressed alike, in rough black homespun and brown felt caps, and all of them much fatter than ordinary Persian peasants. The milk diet and damp atmosphere seems to be good for complexions, for these men all had fair skins, and their whole aspect, and that of their surroundings, was so quaint and uncommon, that it seemed to us that we had fallen in with a lot of amiable troglodytes or brownies of a large breed. Scattered about were huge wooden vessels, in shape like our washhand jugs, holding, say, six or eight gallons; also trenchers and quaint dippers or pannikins of artistic shape, with long handles, carved out of solid hornbeam. Outside, a huge churn formed from a hollowed trunk, and holding about a hogshead, stood fixed beside a bank with a ramp or gangway of wood for the operator to stand on whilst working the piston. There was an air of prosperity about the whole of this "concern" quite foreign to what is usual in ordinary Persian enterprises.

Ismail Khan, the Ked Khoda of Varasun, is a pleasant fellow and interesting, as he has a great knowledge of the folklore of Kujur. He is kindly disposed and good to the poor. He is a believer in the existence of treasure in all kinds of unlikely spots, and told us of books (the names of which I forget) in which full instructions are given how to trace treasure, if once you get a proper start, etc. etc. He told the following stories of how he and his father had missed chances of amassing wealth.

His father, he said, had first thought of digging the ground and

planting an orchard on the spot where we were encamped, and had employed an ignorant hind to perform the manual labour. After some days he came to see how the work was progressing, and as a proof of his energy the hind pointed out a stone some three feet in length by eight inches by ten inches, which he had removed from the ground and thrown over the side of the steep bank which still descends from the orchard to a stream.

The stone, which is roughly hewn, has the impression of a hand, life-size, very neatly sculptured on the smoother side and near to one end. The disconsolate owner begged of the hind to tell him exactly where the stone originally lay, and in which direction the hand was pointing, but, alas, this the stupid fellow could not do, and so the chance of finding the treasure to which the hand pointed was lost! A big depression not far from our tents shows where a trial pit was sunk, and the stone lies where it was thrown by the labourer many years ago. Ismail Khan half thought we might indicate a spot for a second trial pit.

The other case he thus described. "Not many years ago a dervish arrived at Varasun, who, to judge from his straight hair and very dark complexion, was of Indian descent; he had a 'shagird' or pupil with him. The two were kindly treated by me, and prowled about the mountain at their will, nominally in search of herbs, as they professed a knowledge of the healing art, and had a book, which there is now no doubt was a book about magic, or the art of finding hidden treasure. After some time they said they were going over into a neighbouring valley for a few days. They departed, but never returned. A stone carved somewhat in the form of a lion, which had stood on a spur of the mountain above Varasun, and which was always considered to be a sign showing the *direction* in which treasure had been hidden on some distant hills, was found upset and a big hole excavated under it."

Ismail Khan told us legends of an impregnable castle that once existed near Nao Rudbar, the name of which was Kala-i-Mur, a corruption no doubt of Kala-i-Mar, *Mar* being Persian for snake, which having resisted for many years the attacks of the kings of Irak, was taken by the stratagem of sending in the guise of a present thirteen loads of baskets full of snakes, which were let loose by the people who brought the present in the dead of night, on the eve of its formal presentation. The serpents killed all the garrison of the impregnable fortress.

On September 19 we left Varasun. Marching due north we descended into the valley of Kujur, which gradually widens from *nil* to two miles, and has plenty of hamlets and cultivation; side valleys join the main one on either hand. The whole look of the country reminded one of Kashmir, very beautiful and seemingly very rich. Through a gap to the north-west a view of lofty and very distant mountains was caught, the snow with which they were capped proving their great altitude. The streams that flow in from the Kuruk and other surrounding mountains and side valleys are lost in the main valley to reappear as fresh springs at its lower end, where, uniting, they form quite a considerable stream, whose course we followed for five miles

to Nao Rudbar.[1] Below Kujur village the valley becomes, first narrow, and then a mere gorge. The road, fairly good at the entrance to the gorge, crosses from the right to the left bank of the stream, which it has to leave to avoid the slopes that rise steeply from it, taking the softer ground at the foot of the rocks which rise abruptly where the slope ceases. The slopes, as well as the crevices in the rocks, are clothed with verdure, and between Kujur and the sea we saw the following varieties of trees and shrubs, viz., willows, alder, ash, wild apple, pear and plum, poplar, hawthorn, hazel, laurel, box, holly, medlar, sycamore, oak, mistletoe, hornbeam, tulip-tree (?), juniper, fig, walnut, and a tree with a leaf like the alder, the name of which I do not know. The Persian name is Khorda Yalu, probably a corruption of *Khurda alu*=little plum. Near the Caspian the undergrowth was in many places white jessamine and the pretty julibrisin acacia, with a leaf like a sensitive plant, and a pink fluffy bloom which is cultivated as an ornamental tree in the gardens around Teheran, and is there known as the silk-tree. On the shores of the sea, just out of reach of the storm waves, are clumps of blackberry growing in the greatest profusion and covered with fruit. On our way down a thick mist hid the beauties of the scenery, but on the return journey they showed to perfection, with a cascade falling into the gorge just above where our camp had been. We passed close to another cascade falling from a cliff some 300 feet high, but this was between three and four miles farther down stream. Our camp was pitched at Nao Rudbar, and it became evident that for the last four miles of our journey we had been following a cutting, from south to north, through a chain of limestone of that thickness formed by the stream we were following. At Nao Rudbar soft strata cropped out, forming a hollow between the masses of rock formation already referred to and another mass of less altitude, which has a strike east and west here and as far as could be seen in either direction. Mr. Stahl has made a mistake in giving the name of Nao Rudbar to a stream which falls into the main stream from Kujur, some five miles north of the true place of that name, where there is no confluent on the left bank. There are remains of iron-working and the ruins of one or two domed buildings at Nao Rudbar, and a tumble-down stable and rest-room of recent construction show that it is used as a halting-place by muleteers and travellers. The mass of limestone which, as already stated, runs right across the course of the stream, has been eroded into magnificent cliffs, which form a gateway, through which the course of the stream is followed into a picturesque valley or gorge with precipitous sides, about half a mile in length and 200 yards wide. The open space forms a meadow, and not long since, no doubt, was partially, if not entirely, covered by a lake, for even now, along the wall of the cliff, on the right bank, are the remains of a track, partly built out and partly hewn into the rock, which was doubtless used to avoid the lake; and our guide, whom we took from Varasun, said that it was not long since that Shah Nasser-ed-Din caused the barrier of rocks and boulders that dammed the northern end of the

[1] Stahl is mistaken in showing a stream falling in on the right bank from Firoz Kala.

gorge to be removed with gunpowder, and so did away with the pool or lake. It is certain that Nasser-ed-Din did descend from Kujur to the sea a few years ago, and the road, such as it is, below the gorge of Nao Rudbar was constructed for him. It will soon disappear below that place, as the present Shah will probably never care to visit his father's haunts in Mazanderan, much less push down to the Caspian. It is a fact that the late Shah is honestly regretted by the people, such as we met in Kujur. He paid his way during his visits to Mazanderan, and made his followers do likewise. Now the market for their produce, which the Shah's huge camp afforded, is wanting to this people, who are cut off from the rest of the world, and whose produce, except, say, clarified butter, rice, and charcoal, do not pay for transport. Already the traffic kept up in spring and autumn avoids the Shah's road. The riparian population at the former season goes up to Kujur to avoid the heat of the coast country and to till the lands there, descending again in the autumn to avoid the cold. Truly, from the site of the dam to the sea a worse bit of country to traverse is scarcely imaginable. The deep black leaf-mould that forms the soil, the rough rocks and sharp slopes of the side of the gorge are all insurmountable obstacles to any but a properly constructed road. The forest that flourishes wherever a tree can take root prevents the earth getting dry even when mists and rain cease, which apparently is not often. The journey down this gorge is the reverse of pleasant, except for the beauty of the glades, with their undergrowth of ferns, primroses, butcher's broom, and suchlike plants. But after all it only takes four hours from Nao Rudbar to the sea, and an equal distance with very similar difficulties is found on the high road from Resht to Teheran. From the mouth of the gorge at Mula Kala it is two and a half miles to the sea at Sarin Kala. Owing to the thickness of the jungle with its undergrowth of white jessamine, etc., it is not till within a mile of the shore that the sea becomes visible. It then appears to rise so dark and high up to meet the horizon that it is scarcely recognisable for what it is, and looks like a great wall. This strip of two and a half miles from the mouth of the gorge to the shore is of the richest alluvial soil and is well watered. It is, however, only near the shore that patches of luxuriant rice are cultivated. The dark yellow of ripening grain made a most lovely foreground, both to the deep blue of the sea and to the dark green of the forest, and we enjoyed the beautiful scene. We pitched our tents on the grass sward between clumps of blackberry bushes close to a pool, which the pebbly beach had formed by banking up the outlet of a stream. The water-snakes that inhabited the pool evinced great interest in our proceedings, showing their heads above the surface. A surf of waves about two and a half feet high beat along the coast. The brushwood and trees growing right down the beach and to within thirty or forty yards of the water, together with the absence of all tides and cliffs, made the scene like the shores of a lake, which in fact is what one would expect. The trend of the coast in both directions showed plainly we were near, if not actually at, the most southern bay of the greatest of inland seas.

We enjoyed bathing ourselves and our horses, the latter soon con-

senting to be ridden out of their depth and showing far more courage than the Persians, who, one and all, were overcome with fear. One man, whom we knew specially required a bath, and who we insisted should take one, on going in paid two local men to hold him one by each hand. Not so the men who had Turkish blood in their veins, people from Azerbaijan, who serve as grooms. Two of these could swim already. A third actually swam at first trial, and, being held by a waist-belt, paddled out of his depth, whilst his English master swam beside him. This Turkish groom had absolutely no fear of salt water.

With sunset came flights of ducks wanting to settle on the pool beside our tents, whilst strings of cormorants, flying at prodigious rate close to the water, looked for all the world like torpedo boats doing twenty-eight knots an hour. Of real boats or ships none was to be seen, and the peasants of Sarin Kala do not possess any.

A walk along the beach showed that cockles and univalves swarm in the sea, so that Stack's dictum that at Mashad-i-Sar, only forty-six miles to the east, "there are no shells on the shore, no birds in the air," and that "the Caspian looks like the meanest sea in the world" is inexplicable.

The possibilities of this country of Mazanderan have not often been descanted on. It is painful to see how a poor and neglected people continue to neglect them. No doubt the rainy seasons on the shores of the Caspian are unpleasant, but they can be easily put up with in well thatched or tiled houses, such as exist at Resht; and with a good road to the uplands, the latter could easily be reached in a drive of two or three hours. There is really no serious obstacle to be met with from Sarin Kala to Varasun.

Myrtles and aloes, oranges, and mulberry for silk would flourish. Tea ought to be tried. The whole strip along the coast should be a mine of wealth, if only for the rice crop it could produce.

The mouths of the rivers are swarming with salmon. With a rainfall of 55 to 60 inches per annum at the coast and, say, 25 to 30 inches at the same number of miles inland, this should be a country as worthy of development as the Caucasus and the eastern shores of the Black Sea.

The accompanying Table of Altitudes shows the heights above sea-level of the various passes, halting-places, etc., on the route traversed. They were taken with an aneroid, from which both the barometric readings and the altitudes in mètres were read. No temperatures were recorded.

General Schindler kindly worked out the altitudes from the barometric readings without applying any correction for temperature, and the writer reduced the altitudes from mètres to feet. A comparison of the results shows that the latter may well be taken, as they accord with the former, only showing a slightly higher altitude, which we consider may be taken to allow for the increase which would have been shown had the correction for temperature been possible, *i.e.* had a thermometer been used as well as the aneroid.

TABLE OF ALTITUDES.

Name of Place.	Feet above Sea-Level.
Gulahek,	4656
Top of pass between Jaj Rud and Tehran basin,	6107
Bridge Jaj Rud,	5253
Galendavek,	5582
Narun Village,	5779
Village of Afcha,	6599
Plateau half way down on south side of Afcha pass,	8307
Top of Afcha pass,	9866
Ab-i-Safid at Lar side of Yalu pass, shown on Schindler's Map,	8438
Kulayek or Kulwek on Nur river, *vide* Lovett's Map,	6007
Junction of two waterways in gorge between Kuruk pass and Baladeh,	7125
Summit of Kuruk mountain,	9850
Summit of pass out of Kujur valley,	9456
Plateau going from pass to Varasun,	7716
Varasun in Kujur valley,	6173
Ruin in Kujur valley,	5073
Centre of valley below Kujur town,	4656
On road above Nao Rudbar,	3841
Ditto ditto,	3447
Nao Rudbar,	3168
At foot of precipice and on stream,	2068
Down stream at bridge,	1346
Mulla Kala,	615
Caspian Sea at Sarin Kala,	−84

N.B.—Rud = River.
Kuh = Hill or mountain.
Kala and Deh = Village.

THE HYDROGRAPHY OF THE UNITED STATES.

By Frederick Haynes Newell,

Chief Hydrographer, U.S. Geological Survey.

(*Read at the Meeting of the British Association, Toronto,* 1897.)

(*With Maps.*)

In considering hydrography as a branch of geography, it may be claimed that the period of exploration has passed. The location of nearly every stream or source of water is fairly well known and represented on the ordinary maps of States and counties. The next stage of progress, that in which accurate information is obtained as to the

volume and fluctuations of the water resources, may be said to be fairly entered upon. Of few localities, however, can it be held that there exists information concerning the waters sufficiently definite to suffice for ordinary engineering or civic requirements, excepting possibly in the case of some of the principal harbours and larger navigable streams.

The Field of Investigation.

The country to be studied in obtaining a knowledge of the hydrography of the United States is not only large, but also highly diversified in character. The problems encountered have great variety, not only in kind, but in magnitude of scope and in practical application. While in some respects intimately connected, the subjects of hydrographic study have a natural classification, based largely upon geographic divisions, the western or arid part of the country demanding investigations differing widely in purpose from those of the eastern or humid sections. In following out this classification, the rivers of the Atlantic slope, taken in order from north to south, come first; then the Mississippi river and its tributaries, from the Appalachians westwards to the Rocky mountains; then come the Texan or Gulf streams, including the Rio Grande; next to these the great Colorado river, flowing south-westerly into the Gulf of California; after these may be taken up the lost rivers, or the drainage of the vast interior basin of the continent from which no streams escape to the ocean; and, finally, the Columbia and other rivers flowing into the Pacific, the most notable of which are the Sacramento and its tributary, the San Joaquin.

The Purposes of Investigation.

The direct objects of the various investigations bearing upon the hydrography of the country are distinctly economic. Each has in view the accomplishment of some result which shall render available to a larger degree the natural resources adding to the wealth, comfort, or health of the people. Indirectly, however, facts of broad scientific interest are revealed, though the work may not have been planned for this larger end. It is well to keep in mind the object or motive of the various branches of work, in order to better comprehend the causes of the deficiencies or want of symmetry in the resulting body of facts.

The first in time, if not in importance, of the objects of hydrographic investigation are undoubtedly those pertaining to navigation. Since the period of the first discovery of the continent, explorations and the minute mapping of the shores, harbours, and navigable rivers have been almost continuously carried on. The body of facts thus accumulated is in what may be termed a complete form, requiring for the most part merely the continual revision and refinement necessitated by changing conditions and by the more exacting demands of commerce. The methods and results of the surveys of navigable waters are so well known, and have been so widely extended throughout the world, that comment here is not necessary.

Next to the demands of commerce for information concerning waters

are those of the manufacturing industry. In the former case water furnishes the means of transporting the goods, and in the latter, through its momentum in the descent from higher to lower levels, it furnishes power to drive the complicated machinery which has replaced manual labour. It would be a comparatively trivial matter to ascertain the extent and value of available water-powers, if the streams continued with unvarying flow through seasons and years; but, with their constant fluctuations day by day, the problem becomes one requiring years of measurement to determine what may be considered as the available economic power to be realised. At certain seasons of the year the amount of water is vastly in excess of any possible utilisation, and then is a source of danger to structures and to population. At other times the quantity drops below the capacity of the water-wheels or other machinery, and storage of flood waters must be resorted to. In contemplating a new enterprise, it is necessary to know the range in the behaviour of a stream through many years, in order to determine the necessary dimensions and strength of structures to be erected, and to make suitable provisions for tiding over the times of deficient supply. The question of probable profit or loss may be determined by the record of a few days' low water in the past. In illustration may be cited the case of a great water-power enterprise for which capital had been raised and thorough examinations made. It was found, however, that no trustworthy records existed of the behaviour of the river in the past, but the assumptions of the engineers, based on incomplete data, seemed to show that a possible short period of low water might eat up the profits of the enterprise. The project was therefore abandoned. The phenomenally low water of subsequent years, however, never reached the minimum predicted, and it is now obvious that, had the works been erected, failure would not have resulted from this cause. The utilisation of the water-power of the country demands, therefore, the most careful examination conducted through many years, so that, on the one hand, costly experiments may be avoided and, on the other, that these natural resources may not be undervalued.

In the United States there has arisen a third demand for knowledge of the water resources which, in political and social importance, ranks even above the needs of navigation and manufacturing. This is through the extension and higher development of agriculture by the artificial application of water. The nation as a whole has been, and still is, a great landowner, having now in its possession, and at the disposal of Congress, one-third of its area, excluding Alaska. This one-third includes some of the richest and most fertile areas of the continent. It is for the most part open to settlement and private acquisition under what is known as the Homestead Act, but it is practically unavailable to the settler, usually a man of small means, because of the fact that the climate prevailing throughout the vast extent of public land is too arid to allow of the growth of ordinary farm crops. Irrigation must be practised, and, where employed, it has been notably successful and remunerative; but the supply of water is scanty, and in many cases, before an acre of the best land can be cultivated, enormous expenditure must be

made in the construction of reservoirs, canals, and ditches, such as puts it beyond the power of farmers or groups of farmers to make even a beginning.

Throughout the greater part of the western half of the United States all land values are dependent upon the ability to secure perennial supplies of water. The fluid which in the east is in excess, and in many localities is literally free as air, becomes, as the supply diminishes, a valuable commodity. A spring of moderate capacity found within the arid region may be more highly prized than a mine of precious metal; it is a never-ending source of revenue. The limitation of the supply of moisture puts a premium upon careful farming; for, with the warm, cloudless days, and the application of a proper amount of water, combined with thorough cultivation, the largest results are obtained from the minimum acreage. Economy of effort and density of population are thus favoured by the employment of water in agriculture.

The utilisation of the vast extent of fertile public land is a question of great national importance, not only from the standpoint of the citizen as owner of the land, but from many other sides. The arid lands now desert are capable of furnishing homes for a population of millions, and if properly utilised will serve for many decades as an outlet for the congested population of the eastern cities, furnishing a possible solution for some of the most pressing social problems of the day. Before plans involving the utilisation of these lands can be made, it is necessary, however, to obtain accurate knowledge as to the available water supply both above and below ground, and of possibilities of conserving floods and of raising water by machinery from lower to higher levels. With the fluctuations which take place from year to year, it is obvious that such investigations must be continued for periods sufficiently great to show the ordinary range of conditions.

There is yet another series of investigations which, though individually of local concern, are yet found wherever civilisation progresses. These pertain to the supply of water for domestic and municipal use. The quantities to be secured are relatively small—almost insignificant in comparison with those required for navigation, water-power, or even for irrigation—the supply of water for a city of 10,000 people being not greater than that needed to irrigate a farm of 150 acres. But while the quantities are small, the quality is of prime importance, for upon it depend the life and health of communities. As a rule, each city or town, or, in the country, each family, makes its own investigation regarding sources of water; but as population increases the opportunities of enjoying an unpolluted source of supply rapidly decrease. Especially is this the case with cities which, from their location, are compelled to draw water from streams flowing for a considerable distance and possibly crossing State lines. Such streams, in our present state of civilisation, receive with the drainage of the country the sewage from towns and institutions, together with offscourings and refuse of all descriptions. The time is rapidly approaching when vigorous steps must be taken to prevent stream pollution, and in the meantime a thorough knowledge must be obtained of all possible sources of supply.

Passing over many minor demands for hydrographic investigation, there may be taken up as of general interest the class of facts, geologic in character, which pertain to the eroding and transporting power of running water. These matters have interest, however, not only for the student of geology in tracing out the operations by which the present aspect of the earth has been produced, but also for the engineer, who is concerned with the stability of earth and rock, and the formation of bars or obstructions in rivers and harbours. Comparatively little observation has been directed specially to such matters, investigators being content with the derivation of a few somewhat empirical formulæ as to the ability of streams to carry material of certain form and weight.

The Investigations.

From the foregoing abstract of the objects of hydrographic investigations it is obvious that such work must be carried on by many men and by various methods. With the rapid development of the country, and the impossibility of predicting future needs, it has been impracticable to lay out broad lines of research, and field work has, in fact, been devoted to the purposes of the moment. In reviewing the results that have been attained, it may properly be claimed that the pioneer efforts are on the one hand traceable to the efforts of Thomas Jefferson in his advocacy of the establishment of scientific surveys, realised later in the operations of the Coast and Geodetic Survey. On the other hand, as regards the hydrography of the country at large, the foundations may be said to have been laid by the Smithsonian Institution. The history and operations of the Coast and Geodetic Survey have been so fully discussed by others that it is not necessary at this time and place to enter upon them, and the importance of the achievements of this organisation call for more space than can here be given.

Brief reference only can be made to the work of the Smithsonian Institution, the mother of many important governmental bureaus of investigation. It has apparently been the policy of the guiding spirits of this institution, in their attempts "to increase and diffuse knowledge among mankind," to inaugurate scientific work in all lines, and, when any one investigation attained a growth such that public interests ensured its continuation, to dismiss from the parent home this offspring as a separate bureau, usually attached to some one of the executive Departments. In this way the Fish Commission—an independent organisation—took its origin; also the Weather Bureau, now a part of the Department of Agriculture. Possibly the Geological Survey, one of the bureaus of the Department of the Interior, may also be traceable to the explorations fostered and encouraged by the Smithsonian funds. It is apparent that the first systematic studies of the water resources of the United States and the discussion of their possibilities and limitations is due to the stimulus afforded by this institution. Work of this character has, however, been almost entirely abandoned by the Smithsonian, because original research in this direction has been taken up systematically by younger organisations.

The construction of public works for coast defence and for the improvement of navigation has been intrusted to the supervision of engineer officers of the army. The preliminary work of ascertaining physical conditions has necessitated the acquisition of a considerable body of facts in regard to the rivers and harbours, especially in the immediate locality of points where works of improvement are undertaken. The study of hydrography carried on under such conditions is of necessity fragmentary and incomplete, but it is yielding data which, when rounded out and supplemented, must be of inestimable value in the progress toward better knowledge. Each year is adding to the accumulation of data through the maintenance of tidal gauges and of observations of water levels in navigable streams, such, for example, as the Mississippi, Missouri, Ohio, and their principal tributaries, and the larger rivers entering the Atlantic and Pacific Oceans. Besides these operations and the surveys of the Mississippi and the Missouri rivers, various engineer officers are from time to time making special examinations of streams large and small, reporting upon the practicability or advisability of removing obstructions and of providing locks and dams for maintaining navigable stages during times of low water. The information thus obtained is for the most part published in the annual reports of the Chief of Engineers.

The work of the Weather Bureau, in many of its divisions, is of prime importance to the knowledge of the hydrography of the country. It lies at the root of the matter, in that through the records of precipitation facts are obtained as to the distribution of rainfall over the surface of the land. These observations are being carried on at many hundreds of localities, a few records being kept at stations provided with trained, salaried officers, but for the most part they are obtained through the co-operation of persons who voluntarily give their time to the measurement and recording of rainfall and also of changes of temperature. In addition to this, the Bureau maintains on a number of the more important streams a system of gauges under the charge of local paid observers, these being so placed as to give information concerning the rise and fall of the streams at points where the information will be of value in making flood predictions. The system of warnings based upon these observations has proved of great value, not only to commerce, but also to all the inhabitants within areas liable to inundation. Through the notices timely given it has been possible to save from destruction property valued at many thousands of dollars, and doubtless many lives. The observations are made, as a rule, only during the flood season and are discontinued throughout the winter, especially in the case of rivers covered with ice during a great part of this season.

The investigations of the Geological Survey through its Division of Hydrography are designed to give a general yet thorough knowledge of the distribution of water throughout the country, both above and below ground, its fluctuations in quantity from time to time, and the factors which govern its capability of contributing to the prosperity of the citizens. In view of the limited resources available for the purpose, it is not practicable to measure all streams or to carry on studies of under-

ground waters in all places, but attempts are made to select the more important or typical localities, and to obtain facts which will be not merely of local value, but will have a broader application. There are two classes of work involved—one of a somewhat simple engineering character, consisting of measurements of the discharge of rivers at designated points, and computations of the daily flow; the other less direct, necessitating a thorough examination of geologic conditions and the bearing of these upon the occurrence of water and its motion underground.

The measurement of water in the river differs from the ordinary meteorological operations in that we are dealing with a constantly varying quantity, the natural streams fluctuating from moment to moment, often by perceptible amounts. Thus extreme accuracy is practically impossible, even if desirable, for the amount ascertained for one hour in the day on a given date may not again be equalled in a decade. A considerable number of measurements, whose errors, though relatively large, are not cumulative, must therefore be made, and at times and seasons when they are representative of prevailing conditions. The expense, however, of frequent measurements is usually prohibitory, and therefore a further method of approximation must be employed, consisting in maintaining continuous observations of the height of water of the stream, or daily or periodic records made at intervals so short that there can be no extreme variation between them. This is the course adopted, the assumption being that the quantity of water in a given stream in a general way follows the height upon a fixed gauge. That assumption, however, is in error wherever a stream is eroding or modifying its channel to a notable degree. Then the height of water means little or nothing, unless taken in connection with the shifting form of cross-section.

The operation of river measurement as now carried on consists in establishing a gauge at some point favourable for measurement and for observation. Readings of height of water are made, and records are transmitted to the local engineers or hydrographers; at intervals of a few weeks the hydrographer visits the stations under his charge, measures by means of a suitable apparatus—usually an electrically recording current meter—the velocity of the water, obtains by direct measurement the depth and width, and from these data computes the discharge for the height at which he happens to find the stream. The results thus obtained are collected, and from measurements made when the stream is at high and low stages and at intermediate points a graphic curve is constructed, representing what may be termed the average relation between height of water and quantity flowing. From the curve a table is constructed which gives the ordinary flow for each tenth of a foot at which the water stands on the gauge. This table is used in converting the daily record of height into a statement of discharges, from which may be learned the maximum, minimum, and average flow for any particular month or year. Such river stations are being maintained in about 150 localities, for the most part in the western half of the United States, where the question of water supply has an immediate bearing upon the utilisation of the arid public domain. Where the channel of the stream is of such an unstable character that

these simple operations are not applicable, more frequent direct measurements of discharge must be made, as it is usually impracticable to attempt to improve or rectify the channel for the purpose of measurement.

A knowledge of underground waters is based upon a systematic examination of the materials which form the outer covering of the earth. In order to obtain facts concerning the quantity and quality of the contained water and of its probable hydrostatic pressure, it is essential to know not only the topographic structure, but also the position and character of the rocks for a considerable distance beneath the surface. Operations are being carried on mainly within the Great Plains region, where living streams are rare, and where the surface of the ground is so nearly level that it is impracticable to store water in reservoirs or tanks. Here wells must be depended upon to a large extent to furnish not only drinking water, but the supply necessary for cattle and for the cultivation of gardens and of the trees shading the homes of the people. In this country, characterised by uniformity, the rocks are continuous in character over great areas, and examinations extending over a considerable portion of the continent must be made before local conditions can be determined. The underground structure, however, is not as simple as might be inferred from the surface, for the older and deeper rocks have in many places been decidedly flexured or even faulted, especially at points near the foothills. Thus, while predictions can be made as to the thickness of the rocks over considerable areas and the depth to certain water-bearing strata, yet these statements must be carefully checked by a thorough search for interrupting causes.

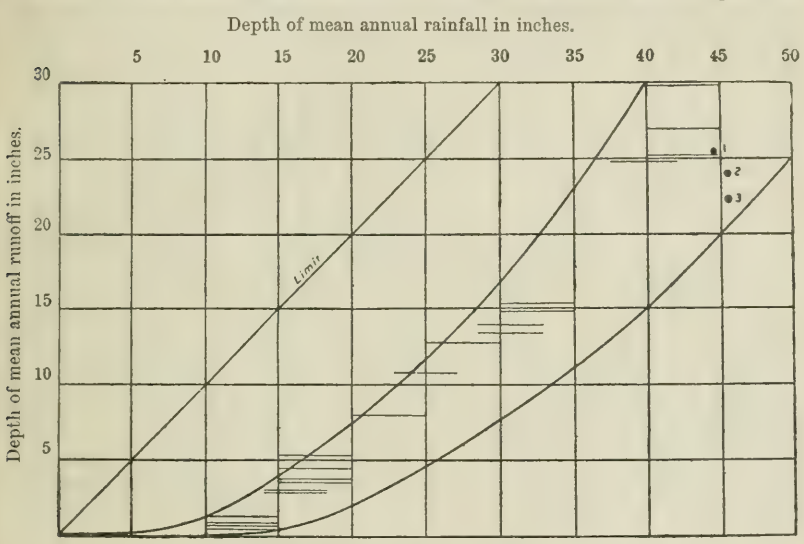
The method of work consists in careful examination of the surface rocks of all places where outcrops may be expected, and the collecting and comparison of records of wells, especially those of notable depth. The exposure of the upturned edges of the Plains rock against the mountains affords opportunities of estimating its thickness, and this in turn is checked by the examination of outcrops in ravines and by measurements obtained from deep wells. The character of the water-bearing beds must be determined from these outcrops and from the borings, and in short every available fact and inference must be utilised in adding to the mass of information.

Results.

The results of the various branches of hydrographic investigation, when rounded out, give a complete history of the progress of the cycle of existence of water from the time it reaches the earth as rain until it is again returned to the air by evaporation, or fixed more or less permanently in the tissues of plants or the rocky crust of the earth. This life-history embraces not only the progress of the water from point to point, but also its quantity, distribution, extent, and depth in the rivers and lakes and on the navigable coasts. The progress of events in such a history can be discussed under several heads, the principal of which are the quantity and distribution of the rainfall, the amount of

water which runs off the surface of the ground to form streams, commonly known as the runoff; next the portion which is early evaporated from the soil or from plants growing in it is considered; and, lastly, that which sinks underground, percolating for considerable distances to form relatively permanent ground-waters or to re-appear, in part at least, in springs and ordinary or artesian wells.

The great body of facts thus far acquired consists of measurements of rainfall made by the Weather Bureau, of records of river height kept by this organisation and by various officers of the army, together with occasional discharge measurements, made at irregular intervals. To these must be added the measurements and computations of daily and monthly discharge of various streams resulting from the field work of the Geological Survey, and a considerable body of facts relating to the



Relation of runoff to rainfall.

occurrence and movement of water underground resulting from the studies of various geologists. This somewhat heterogeneous mass of material is being digested as rapidly as possible by the Division of Hydrography of the Geological Survey, with the intention of preparing a systematic description of the hydrography of the United States.

One of the first results to be attained, but one for which many more facts are needed, is the relation existing between rainfall and runoff under various conditions of topography and culture. Tentative conclusions have been drawn and expressed in the form of simple diagrams. If all the rain that fell upon the surface flowed off in the streams as from a roof, then with, say, 40 inches of annual rainfall, there would be an equivalent depth of 40 inches of annual runoff; but, as a matter of fact, from the ordinary mountainous country only about 30 inches in depth of runoff may be expected, and from surfaces of less relief, as the rolling prairies and foothills, about 15 inches in depth of runoff per year. On

the other hand, with 20 inches of rainfall, the amount running off from the mountainous country is approximately 7 inches, and from the prairies 2 inches. With half as much rainfall, or 10 inches in depth, only about 2 inches per year can be expected from the mountains and practically nothing from the plains. In other words, with a mean annual rainfall of less than 10 inches, or from 10 to 15 inches, no living streams can be expected outside of the mountains, and, as shown by the map of the United States, rivers rising in regions of such aridity disappear upon reaching the lowlands, so that the great arid region of the west is characterised by its lost streams.

Another set of results that are being obtained regards the average discharge of the rivers of the country. It is recognised that, with the great seasonal and climatic oscillations that take place, the streams have great range and may never flow for any considerable length of time at their average rate, but nevertheless, even with these wide and irregular variations, it is a matter of considerable moment to know what has been for a period of ten years or more the average discharge of the streams at certain points. This average discharge, when represented diagrammatically on a map, enables the student to see at a glance the relative importance of various rivers, as well as their length and position.

The average quantity of water carried by rivers at various portions of their course being ascertained approximately, it becomes practicable, upon this basis, to study the variations from the mean, and to fix a standard by which to express the relative excess of floods or the relative deficiency of droughts. The intensity and duration of these are matters of great importance, both in their practical and scientific application, and can only be satisfactorily discussed when results have been obtained covering a considerable range of time. When such data have been assembled and arranged for convenience of reference, it will be possible for individuals—officials, engineers, or promoters—to discuss the practicability of enterprises designed to promote the health, comfort, or wealth of the people.

PRIMARY CONDITIONS OF TROPICAL PRODUCTION.

BEING AN INTRODUCTION TO ECONOMIC BOTANY.

By G. F. Scott Elliot, M.A.

The idea of studying this subject arose from my own experience in Africa and Madagascar. I have very often seen both serious financial loss and waste of valuable life through a misunderstanding of the most obvious rudimentary laws of plantation. To our own country the subject is of increasing importance. Against our imports last year of £441,808,904 we can only place a poor export of £296,379,214. This leaves a balance paid away of over £140,000,000. It is not necessary to go into the political economy of the subject, but there can be no doubt that this money for the main part passes over to support American and German

families. Our exports to, and imports from, our own colonies and protectorates are, on the other hand, nearly the same—namely, about £90,000,000 and £93,000,000 respectively. So long as the money passes to British planters and manufacturers abroad, this adverse balance scarcely matters, for it remains, so to speak, in the family; but when it passes to foreigners it constitutes a danger. Nor when we look at the conditions of these foreign markets is there much encouragement. The American and Russian Governments are deliberately trying to make their States independent of all outside support. Neither country is in the least likely to be ruined. Germany is, on the other hand, not merely more or less self-centred, but enters as a capable, well-equipped rival to ourselves everywhere. What will become of our export trade in the future? Now the answer depends on two points, viz.: the opening up of new markets, and a right understanding of the capacity of our own possessions to meet our own import requirements. The last is in reality the study of plantations and cultivation in a broad and general sense.

The factors which determine the possibility of successful cultivation of a plant in a particular spot are of two kinds.

One set of "determinants" depends upon the plant itself, the other depends upon man's use for its product.

The three determinants which depend upon mankind are—

1. Security of life, property, and fair treatment.
2. The size and expansibility of the market.
3. Labour in its double sense, managing and manual labour.

The others, depending on the plant, are:—

4. Climate, sunshine, and moisture.
5. Soil.
6. 'Standort' or 'habitat.' This last may be described as the special conditions of the spot as regards wind-shelter, slope, and aspect.

Let me explain the bearing of these determinants on cultivation more carefully. As regards the first, it in no manner affects any country under the British flag, but in the Central and South American republics, or even in Madagascar, or Bourbon, or other French possessions, an Englishman does not, as a matter of fact, obtain the same opportunities as the native. Frenchmen are more patriotic in this respect than ourselves. On the other hand, in our own colonies British officials are so nervously anxious not to be unjust to a foreigner that the Englishman has no corresponding advantage.

The size and capacity for expansion of the market comes next. It is usually ignored in text-books, but I will choose the three substances annatto, castor oil, and lily, or Monocotyledon, fibres as warning examples. All three are often recommended in Government publications for cultivation. Now annatto does not in a good year obtain a high enough price to pay for the cost of gathering from the trees. As castor oil grows and can be profitably cultivated in Europe, is it possible that any sane person would go to the West Indies to grow it? As for the lily fibres, they are at present mainly used for rope and twine making: the market is therefore very limited, and I maintain that any one who had mastered this fact

should have been able to prophesy the disasters in Mauritius fibre cultivation, and also the drop in price from about £50 to about £12 or £14 per ton, which has been experienced quite recently in this set of fibres.

Another point is of an arithmetical nature. We imported in 1896, roughly speaking, £10,500,000 of tea, £3,500,000 of coffee, £1,500,000 of cocoa. The effect of an extra supply of, say, £1000 worth of these substances is very different. On the cocoa market it is $\frac{1}{1500}$ of the whole, quite enough to exercise an influence on prices. On the tea market its effect would be scarcely perceptible, being only a $\frac{1}{10500}$th part. Therefore in the case of cocoa or any such substance, recommendations must be less freely given than in the case of tea. Of this principle, I find scarcely any trace in ordinary literature.

The third determinant, labour, is very greatly affected by climate. In the temperate zone, one *expects* an energy, economy, and intelligence in management which can scarcely ever be obtained in the Tropics on account of malaria, dysentery, absence of books and communications, etc. Hence follows an important principle: If any special product can be obtained both in temperate and tropical climates, the temperate production has an advantage over the tropical, and will usually stamp it out in the long-run. An instance is the beet and cane sugar struggle. Not merely is the beet driving out cane sugar, but improvements in sugar-extraction, invented by beetroot manufacturers, are now being applied to cane sugar, although canes have been grown in Barbadoes since 1664 and beetroot is a thing of this century. It is forgotten by most writers that before bounties existed beet cultivation increased on the Continent till the surplus had to be exported, so that this is not a bounty question.

This effect on management has led to rules of leave-home after so many years abroad, which probably exercise a more favourable influence than is usually supposed. A man with twenty years of experience in one culture is more than four times as valuable as four men with only five years' knowledge. Twenty years' experience is not possible without frequent leaves-home.

Another effect of climate on management is the obvious disadvantage in a bad climate of cultivating any plant which does not yield within three years. It is only by Governments or large companies that rubber trees can be planted—in Sierra Leone, for example. No private individual should be advised to run such a risk. The *average expectation of life*, therefore, should also determine in any place the prospects of a particular cultivation.

Turning to manual labour, it is probably the case that no one works unless he is obliged to do so. Therefore labourers only exist in densely populated places—that is, in fertile places under a strong government. Hence we have the four great labouring nations of the Tropics—Indian coolie, Chinese, some Kanakas, and some Kaffirs. As the land is densely settled in their birthplace, a system of importing manual labour has arisen, mainly of British origin. Thus the Kaffir at Kimberley, the Indian coolie at Demerara, the Kanaka in Queensland, and the Chinese in Sumatra are induced to work for a term of years under a system of Government inspection and control. Often the plant, *e.g.* sugarcane, the manual labour

(Kanaka), and the British manager are all alike aliens in the country. The limitation to this system is political: in, *e.g.*, Natal, there must at some time be a war of extermination between the Indian coolie and the Kaffir, at which our British descendants must assist. At any rate, it is probably true that labour is nowhere a serious obstacle. The crying want of the day is not want of hands, but the world-wide difficulty of over-production.

The fourth determinant, climate, depends upon the number of hours of sunshine, and probably the number of rainy days, in the particular place. Therefore an exact classification in the Tropics would be by the amount of rainy days, seeing that sunshine is never wanting. On the other hand, in temperate countries it should be according to the hours of sunshine in the vegetation period. Neither of these points is recorded in a very satisfactory manner over the whole earth.

One may, however, on the principles worked out in Germany by Warming, Diels (New Zealand), and others, divide the Tropics into certain well-marked main climates, which are distinguished by their natural vegetations.

They may be classified into four groups:—

Wet coast jungles without any dry season, owing to sea breezes and the winds generally blowing inland.

Good examples are the Oil Coast and Sierra Leone in West Africa, the Amazon valley, and the Zambesi. Characteristic plants are the oil palm and *Hevea brasiliensis*.

Another climate without a markedly injurious dry season is the *Insular Tropical*, such as is found in Manila. This differs in its being much more healthy than the coast jungles, and probably not on the whole so humid. It is best characterised by the cocoanut palm, sugar-cane, and bread fruit.

A very distinct third climate is what may be called the *Condensation* forest. The moisture-laden winds from the sea may have to pass over a whole continent before they become precipitated on a mountain range. There a dense forest arises.

The Himalayan slopes in the tea districts of the Dooars and Assam are good examples. Quinine as well as tea seems to belong to this condensation region, which is never of large extent. It differs from the previous climates in the monsoonal character of the rain. There is, in fact, a dry season with marked effect on the vegetation.

Lastly, within the Tropics we have the ordinary plateaus and valleys in which periods of heavy rain alternate with long droughts. These may be called *Monsoonal Climates*, lands in these places varying greatly in their natural covering from thin, dry, and scanty grasses and *Cyperaceæ* to a fairly dense shrub or even forest; but much deeper investigation is necessary if a satisfactory division of them is to be attained. Yet in my opinion there are three well-marked varieties—natural grass, acacia shrub, and thin forest lands.

Most tropical products fall within this monsoonal area.

Deserts extend from the Tropics to temperate regions, and form a division by themselves.

Continuing this principle, we have outside the Tropics :—

1. *Winterless Subtropical* countries, where the olive cannot be grown, but where bananas thrive satisfactorily.
2. *Sunny Temperate* countries, with a slight winter, and best marked by the olive and fig, such as the Mediterranean generally.
3. *Wet Temperate* countries like Great Britain.

Now every economic plant is most profitably cultivated in one or other of these divisions. Such a plant as the banana may extend through all except our own climate, yet will only in practice yield the best profit in one. Many plants are rigorously confined to one special division. The attempt to pass beyond it is often tried, but it is never satisfactory.

For example, rubbers are almost confined to wet coast jungles and river valleys, date-palms to the desert, and so on.

The next two determinants are most satisfactorily treated together. The value of most soils depends on the amount of vegetable or organic matter, and the state of division of the soil. Geological characters are important chiefly so far as regards three points. The decomposed fragments of some volcanic rocks are specially rich : limestones or coral rocks are very good for certain plants and fatal to others : certain special strata, such as the barren mudstones in this country, are particularly bad. It is the amount of vegetable or organic matter which in most cases distinguishes a fertile from an infertile soil, provided other things are the same.

It is instructive in this respect to trace a river from its source to the sea. From the condensation forest and from snow-streams thousands of burns begin to unite into rivers; these form a "plexus," or tangled mass of valleys, and bring down immense quantities of vegetable matter from the humus of the forest which clothes all their sources. For a certain distance there is but little flat ground in the valleys: after a time the river begins to meander through a wide valley of flat, alluvial holms, and it may at the end form a rich delta. The "habitat," or "standort" will be very different according to which of the following places are taken :—

1. A steep burnside clothed with condensation forest in the "plexus."
2. A holm which is within the mountain system.
3. "Meander," or alluvial flats subjected to inundation.
4. Similar alluvial ground not subjected to inundation.
5. Ordinary soil of the country just outside the "meander," which is not enriched by the river at all.

Thus the first Assam garden near Sundiya appears to have been in a habitat such as No. 3. Other gardens were placed on such as No. 1. Now a favourite position is No. 2. The fourth position is usually a very favourable one. The fifth is infinitely inferior to it. The slope and altitude, but especially the character of the natural bush or jungle, ought in all cases to enable a trained observer to tell at a glance in which position a particular spot is situated. One of the most obvious things to do is to test the depth of soil by digging; yet I have seen a whole coffee plantation which had died, after flourishing three years, through the taproots reaching rock.

Wind-shelter has a remarkable effect in improving the annual amount of vegetation depending on the increase of organic matter within a

soil. But the manner in which any given spot can be protected is not easy to tell. At Ujiji a clever Arab had kept all locusts off his crop by a series of vertical screens, with a ditch in front of each to catch the impinging locusts. In Holland, tobacco is wind-sheltered in a similar way; but who can give a mathematical formula for the distance at which such screens should be placed, and should they be at a slope or erect?

Thus of the determinants, soil and habitat, we may draw up the following abstract:—

For *Soil* (*a*) depth; (*b*) geological character; and (*c*) amount of vegetable or organic matter are the most important characters.

For *Habitat* (*a*) liability to floods or stagnant water; (*b*) wind-shelter; (*c*) slope; and (*d*) aspect to the sun are the most important. The latter is of course a familiar point to all land valuers, and it is mathematically obvious that the slope and aspect together determine the amount of sunshine received on any spot on a clear day.

The attempt to bring the more important economic plants into definite places as regards all these determining points of their cultivation is exceedingly difficult, chiefly because it is a question not of botany, or political economy, or meteorology, or geography, but of a mixture of all these sciences. Yet it is distinctly worth the while of any one who proposes to settle or reside abroad.

At present, if we take the following substances, and group them according to the share of our colonies in supplying us, we find—

A. British supply in excess of foreign supply.
   Cocoanuts, palm oil, sago, cinnamon, ginger, pepper, cocoa, tea (between six and seven times the foreign), quinine, cutch, and gambier, indigo (as 1438 to 95), myrobalans, kauri gum, guttapercha, and jute.

B. British supply about three-fourths of foreign supply or more.
   Gums, cane-sugar, tobacco.

C. British supply of considerable importance.
   Coffee (2·63 to ·92), linseed (2·8 to 1·2), castor oil, hemp (1·5 to ·3), caoutchouc (3·9 to 1).

D. British supply of no importance.
   Cotton (35·2 to 1·0), opium, sumach, valonia, flax, almonds, lemons, oranges, olive oil, oilseed, esparto, cotton seeds, beet sugar, chicory.

As far as actual values go, the foreign supply of these substances is worth £348,600,875, and the British only £93,208,029—that is, the former is from three to four times the latter amount.

Yet there is no reason why any one of these articles should not be cultivated in the British Empire, which contains all climates.

It is to be remembered that we are *not* a free-trading country; we heavily tax tea, tobacco, coffee, and cocoa. We prevent the cultivation of chicory at home, and pay to Belgian farmers some £48,000 annually for what is simply a useless adulterant of coffee. The money now raised on tea—a British industry—if produced by differential taxes in favour of our colonies on other articles, would probably lift the West Indies on to a better level, strain a little closer the loose bands of our Empire, and remove a serious and yearly increasing danger.

GEOGRAPHY AS A UNIVERSITY SUBJECT.

By William Morris Davis, Professor of Physical Geography, Harvard University.

(*Read at the Meeting of the British Association, Toronto*, 1897.)

Geography may justly claim a place among the scientific subjects that receive attention in universities, for its content is by no means exhausted in the lower reaches of education. The information that it imparts is of great importance; its disciplinary value may be fairly given a high rank; and, as with any other subject, the effect of recognition in the university would have a most salutary effect on geography in the schools.

Yet, in spite of these advantages, the colleges and universities of Great Britain and the United States do not, as a rule, give geography a place of importance in their list of studies. If admitted to their lists at all, it is generally placed subordinate to some other major subject. It receives only the second thought of the instructor in charge of it, and his best thought is applied to history, geology, or elsewhere. In view of this, the burden of proof must lie with those who would change the existing order of things. Anywhere but before an audience largely British, I would gladly accept this burden; but here it is with some diffidence that I urge the claims of geography, for it might be supposed that a nation that is practically lacking in geographical teaching after its school days would be timid in going to unknown parts of the earth, and would as a rule dwell at home, instead of colonising other countries, and would hardly venture into world-wide commercial enterprises. Yet where in the world is a nation to be found bolder in exploration, stronger in colonisation, and more active in commerce, than Great Britain? The nation having done so well for many years without any advanced study of geography, and still getting along comfortably with only a little geography of university grade, it is perhaps not to be wondered that British universities are slow in taking up the responsibility of this apparently unnecessary subject, when so many other subjects are clamouring for recognition or expansion. I shall not attempt to explain how it is that so much has been done by British explorers, colonists, and merchants without a thorough study of geography, or to infer what more they might have done if they had had good geographical training in the past. Suffice it to return to the contentions of the first paragraph, in the hope that a fuller statement of them may lead to some betterment of geography in the future.

It is the exception to meet with a person of mature years who recalls his study of geography in school with satisfaction. He remembers that he had to memorise a lot of names, that different countries had various gaudy colours on a map; but he does not find that what he learned is of much service, except in such commonplace matters as location, boundary, and chief cities of the more important countries—matters that are useful enough, truly, but that have about the same relation to

the whole subject of geography as spelling has to literature. He may be a college graduate, and he may even have passed some years in the graduate courses of a university; but these many years of study have given him little opportunity to reach the richer content of geography proper. Something of geography is touched in history, but the historian is commonly informed only in the merest rudiments of physical geography, and he is so much occupied in tracing out the sequence of recorded human events, that his attention to geography can be no more than that allowed to any other subordinate correlated study. Geographical problems are also encountered in economics, a study of growing importance; but the economist is rarely, if ever, a specialist in geography, and his students get from him only slight geographical contacts here and there; every contact valuable in its way, but incompetent to present a vivid idea of geography as a whole. That can be gained only when geography itself is the first responsibility of the teacher, and the first object of the student. Crumbs of history and economics will be gathered along with geography, when professorships of geography are established; but professorships of history and economics should not be abolished for that reason.

It may be urged that when the present generation of boys and girls reaches maturity, their memory of school-day geography will give them no reason for complaint; inasmuch as the teaching of geography to-day is much better than it was a generation ago. This is in a large measure true. Geography is to-day an interesting and profitable subject in many schools; so much so, that those who study it will be dissatisfied if opportunity is not offered them to continue the study in college. The beginning now made is often good; but it does not for that reason reach the end. For the explorer, the traveller, the colonist, the merchant, school geography cannot suffice, however well it is taught. All such persons, and many others, would profit greatly if they could continue the study of good sound geography later than their early school years, when geography is now generally "finished."

The information that geography imparts is of so great importance that, if it is not gained in school, it must be gained in one way or another during later life by all who have to do with the world at large. This is as if an engineer had to pick up, as best he might, all knowledge of mathematics of higher grade than what he learned in early school years. He might succeed, but he would be working at a great disadvantage. What instruction would be more worthy of mature attention than an exhaustive account of our physical environment on the one hand, and of our manner of responding to it on the other; both subjects being exemplified by numerous instances, and further impressed by an effective setting forth of their many natural correlations. Thus presented, the geography of the British Isles, or of the United States, would furnish material of advancing grade, as long as one chose to pursue it. It cannot therefore be admitted that there is any reason inherent in the nature of things that must always operate to keep geography out of the university; and at the present rate of increase in the variety of subjects found among college studies, I fully expect to see geography there,

along with various other new-comers, before many decades shall have passed.

When that good time is reached, it will probably be less common than now for the explorer to cross an unknown land without due preparation for seeing and describing it. Geographical societies may require careful preparation and serious investigation of their candidates for membership. The traveller who goes far to see the wonders of the world will be less indifferent than now to the simpler features that he passes on the way; and with his increasing perception of their variety and interest, his pleasure will increase also. When the explorer and the traveller are better equipped to take advantage of their opportunities, we may find their writings less immature geographically than is now commonly the case; and the geographical journals and books of travel of the end of the next century may contain something more than a school-boy terminology. It is indeed not a little amusing to underline the technical terms in the report of some brave geographical explorer; for with few exceptions they savour of his early boyhood. This is not the case with the report of a botanical explorer; he has had opportunity to learn an appropriate and mature botanical terminology before starting on his travels, and his report gains greatly in accuracy and terseness thereby. The geographical explorer is too often so little trained in geography that he does not see what he looks at; he does not know what he sees; and he cannot say what he knows. His readers gather only a faint impression of the landscapes that passed before his eyes, and of the manner in which their occupants were influenced by them. Little wonder need be felt at this; for it is no easy task in the first place actually to see the geographical forces that one traverses, and in the second place to describe the observed forces so sharply that they cannot be misunderstood. Appropriate training is as necessary here as in any other difficult task; and the needed training surely cannot be had in a low educational grade.

Chiefly through the training that it would afford, a strong all-round geographical course would prove a valuable discipline. It is not necessary to compare its disciplinary value with that of other subjects; it suffices to be assured that it is of high value. No one who examines its many sides can fail to admit this. My own interests turn chiefly to the inorganic side of the subject, and for that reason the inorganic side will be chiefly referred to here; but I believe that the organic side of geography is of no less intellectual strength. Any one who has gained competence to observe correctly and to describe vividly the actual facts of our physical environment in the lands, the waters and the air, has also gained a vigorous mental discipline; and one of the most valuable elements of this discipline lies in its possession of an inherent rational element. The day has passed when it is sufficient merely to describe an element of land form. We are now so well persuaded that all elements of land form are susceptible of rational explanation, that empirical description no longer suffices; it must be replaced by explanatory description. It is often impossible to reach this advanced stage without further investigation than can be given at the time; and to just that

extent the investigation does not satisfy us. For such unfinished studies the older-fashioned empirical terms are still serviceable; but the inquiring mind will not rest until at least a determined effort has been made to replace them by explanatory terms. It used to be sufficient merely to describe a plant without classifying it. Then it came to be necessary to classify it; that is, to recognise its relations to other plants. Now nothing less than an explanatory classification, involving relation through descent, will satisfy the modern botanist. Geography is to-day less advanced than botany; but there are already many signs that nothing less than a thorough-going rational terminology will satisfy the geographer of the next century; and the more thoughtful and energetic students of geography to-day are putting forth their best efforts to be ready for the next century when it comes.

There is another result of the higher study of geography that deserves mention along with its disciplinary value; that is, the increased pleasure that one feels in the presence of nature, when he has made at least a beginning of understanding what he sees. The most monotonous plain, the most sterile desert, acquires an interest that falls not far behind that excited by the most lovely landscape. Nature has spent time and effort over one as well as over the other; each one has its place in the economics of the world, and it is for us to learn what that place is. Understanding and sympathy go together in such a task, and enjoyment is their companion. Not less than many other scientific subjects, geography may escape from the reproach of being purely an informational subject, and vie with the humanities in providing inspiration.

If for no other reason than that its recognition by the university would improve its status in the schools, geography deserves a place in the higher education. Most unfortunate is the educational position of a subject that is "finished" in early school years. Not only must the pupils feel less respect for it, but the teachers as well must esteem it less than other subjects which are continued to the top of the educational scale. No adequate preparation for teaching it can be obtained, for its study is not continued into mature years. Little inspiration for its improvement can be expected under such discouraging conditions. It may be safely contended that it is through the invigorating influence of the colleges that the work of the schools is chiefly stimulated. With us, it is the normal schools that have stood farthest aside from college influences; and it is often in the normal schools that scholarship is at its lowest grade. It is a rule that the best teachers, the best text-books, and the best educational methods have entered the secondary schools from the colleges. Exceptions may be pointed out, but they do not preponderate. Such educational improvements as Latin at sight, original problems in geometry, laboratory methods in physics, the more rational study of elementary history, have with us received much greater impulse from the colleges than from the schools in which they are taught. The impulse may come directly from the college through the requirements of its admission examinations; or indirectly through its graduates acting as school teachers. Compared to these improvements, those made by school teachers independent of all college influences are small indeed.

Until very lately, geography has been isolated in the school, and held remote from college influences. It is true that at some of our colleges a slight qualification in geography is required for admission; but this qualification is never held in high esteem. It has trifling value as compared to classics or mathematics; its influence on school geography is rather pernicious than otherwise, because as long as it is nominally required and easily passed, it will be rated as of little importance. Nothing will so effectively correct this difficulty as due recognition of geography in the colleges themselves.

Once entered on the list of studies in the colleges, geography will not have long to wait for an opportunity in the universities; for the very fact that formal instruction is given in geography by a college instructor will, in the prevailing spirit of college work to-day, lead some college teachers of geography to become investigators, and to offer opportunity for investigation to advanced students: and that is the essence of university work.

Thus far, I have dealt with generalities. Now allow me to justify at least some of them by particular instances. At Harvard, we still lack systematic instruction on the human side of geography; but in connection with our courses in archæology and ethnology, this deficiency will, I believe, soon be remedied. Our courses in physical geography, or physiography, as they are coming to be called, have fortunately been associated with the department of geology from their beginning. In deference to their growing importance, the department is now called by the double name of "geology and geography." They include elementary courses on the physiography of the lands and seas, and on meteorology; courses of a more advanced grade on the physiography of the United States and of Europe, and on climatology; and opportunity for investigation of special topics by advanced students. We are in various ways closely in touch with the secondary schools. In the "summer school" of the university we have recently offered an elementary and an advanced course in physiography, the former rapidly growing in favour with school teachers, who give part of their vacation to it. We are on the point of adopting alternative admission examinations in physiography and meteorology; detailed outlines of recommended preparatory courses having been prepared in both these subjects. Some of our better secondary schools are already prepared to give competent instruction in these subjects. In various other ways, our relations with teachers of geography in secondary schools are continually extending; and it is very gratifying to see that suggestions made as to subject and method are welcomed by our visitors and correspondents. It is true that these calls on the time of college instructors interfere with that part of their duties which is concerned with original and advanced study; but it may be answered, if this interference is regarded as objectionable, that its rising amount only measures the fulfilment of another class of duties. Few other efforts have lately demanded so much of our attention as the designing of a series of geographical models,[1] constructed last winter by Mr. G. C. Curtis under my

[1] An account of these models has recently been published in the *Proceedings* of the Boston Society of Natural History. See *S.G.M.*, vol. xiii. p. 607.

supervision, and now in process of multiplication for sale to schools; the demand at present exceeding our supply.

It is therefore by actual practice, as well as by general precept, that I advocate the recognition of geography as a university subject.

DR. SVEN HEDIN AND LIEUTENANT PEARY.

THE members of the Society have seldom, if ever, enjoyed the advantage of listening to such attractive lectures as those delivered last month by these noted explorers. In the subject-matter of their addresses there was, indeed, hardly anything of striking novelty, for the principal geographical facts revealed by their expeditions have been made known through their communications to various geographical periodicals, and by the daily press. But an account from the lips of the explorer himself exercises an attraction far greater than any written narrative, especially when he is capable of riveting the attention of his audience, and possesses the power of making his hearers thoroughly understand the character of the regions he has traversed, and the people that inhabit them. This Dr. Hedin and Lieutenant Peary were able to accomplish to a marked degree, especially as they had brought home collections of very instructive photographs, and could therefore appeal to the eye as well as the ear.

The scene of the Swedish traveller's exploits was the heart of Asia, his chief results being obtained in the country between Mustagh-ata and Lob-nor, though he afterwards penetrated into Tsaidam and completed a traverse of the whole continent at Pekin. After a few words on his journey from Marghelan to Mustagh-ata, he briefly alluded to his four attempts to reach the summit of that mountain, some 25,000 feet above sea-level, and his sounding of the Kara-kul, for which purpose he had to construct a boat himself—a very unstable vessel.

After a visit to Kashgar Dr. Hedin started on his terrible journey across the Takla-Makan desert, between the Yarkand Daria and Khotan Daria, in which half of his caravan perished from thirst. Here the lantern slides were used with great effect to depict the desolate sea of sand, with its endless dunes running like huge billows from north to south, and its sand-storms so darkening the air that the members of the party had to follow one another closely lest they should be separated. During the last twelve days the party travelled over a desert of the most desolate kind, where not a trace of vegetation relieved the weary monotony of the sand-dunes, where no spoor of any animal was ever seen, and where at last even the moths and mosquitos were left behind. The camels sank into the sand in trying to surmount the steep western crests of the dunes, and one night a violent storm from the north-east covered the whole camp so deeply in sand that many articles had to be fished up with sticks. A man of the party had been ordered to lay in at a lake by the Mazar-tagh a supply of water sufficient to last for ten days, but, thinking that the distance was not long to the Khotan Daria, he filled the cisterns with enough for four days only. In spite of strict economy this supply was

exhausted some days before the journey was ended. Stores had to be left behind, first preserved meats, sugar, honey, etc., then furs, rugs, cooking utensils, and at last all but the most indispensable articles, such as money, diaries, maps, and a small amount of provisions. Two of the men also were at length able to go no farther; they were last seen lying on the sand where they had fallen, and were never heard of again. On the following night another man fell down exhausted, and Dr. Hedin, leaving everything behind, struggled on with his remaining companion, Kasim Akhun, for three days more. On May 5th they had to lie down during nearly the whole day, unable to move from the heat and exhaustion. Nor could Kasim Akhun move when the sun set; his tongue was white and dry, and his lips were blue. Dr. Hedin had therefore to make his way alone through the forest that then lay before them, and indicated the presence of water somewhere in the neighbourhood. After three hours' wandering he came in sight of the Khotan Daria, and presently found a pool of fresh water, at which he slaked his thirst, and filled his boots to revive his dying servant. It was three days before Kasim recovered his strength sufficiently to travel, during which time Dr. Hedin wandered along the bed of the river towards the south, subsisting on plants and tadpoles. On May 8th he fell in with three herdsmen, who supplied him with bread and milk. Another man of the party also turned up, bringing most of the instruments, diaries, and maps; and the three then returned to Kashgar.

Dr. Hedin also spoke of his subsequent journeys to the Lob-nor, which has gradually changed its position during the last two hundred years, and now shows a tendency to return northwards to its former site; and alluded to the remarkable buried towns he discovered to the east of Khotan, a thousand years ago the seat of a somewhat advanced civilisation; and to his excursion up the Cherchen Daria into Tsaidam, and his journey by Southern Mongolia and Ordos to Pekin.

The chief geographical results of his very fruitful journeys have been noted in the *S.G.M.*, vol. x. p. 597; vol. xi. pp. 584, 642; and vol. xii. p. 643.

The lecture of Lieutenant Peary was probably still more highly appreciated by his audience; and for several reasons. In the first place, Arctic exploration has always exercised a great fascination on the minds of the British public, whose country has sent out so many expeditions to the northern seas, and done so much to remove the mystery that is now fast vanishing away. Moreover, Lieutenant Peary is a master of the art of lecturing, and had not to contend with the disadvantage of speaking in a foreign language. For more than an hour and a half he held the attention of the audience, while he gave a sketch of his expeditions, described the Eskimos of Northern Greenland, and explained the plan by which he hopes to reach the Pole.

It is now several years since Lieutenant Peary first turned his thoughts to Greenland. In 1886 he made a journey of fully a hundred miles from Pakitsok fiord, Disko Bay, over the inland ice, marching for three weeks into the interior, and reaching an altitude of about 7700 feet. Having

thus acquired some knowledge of the inland ice and the conditions of travel in Greenland, he mapped out three routes for future expeditions. The first was from Kristianshaab, south of Disko Bay, to Univik, on the east coast. This route was afterwards selected by Dr. Nansen; he travelled in 1888 in the reverse direction, starting from Univik, and was obliged by the looseness of the snow to turn aside to Godhaab. The second line was from the west coast to the head of Franz Josef fiord, which he supposed to run far into the interior; while the third was that which he subsequently so successfully followed across the northern part of the huge island.

In 1891 Lieutenant Peary was able to start on his enterprise. In July the *Kite* landed Mr. and Mrs. Peary and their party in Whale Sound, and in the following summer Lieutenant Peary and Mr. Astrup made their memorable march to the northern coast, proving that Greenland does not extend much beyond the 82nd parallel of N. lat. Compelled by the direction of the fiord on the northern coast to turn south-eastwards, they came to the open sea at Independence Bay, and returned by a more direct course to Whale Sound, thus also avoiding the deep fiords and crevassed glaciers that had so much hindered their progress on the outward march. During the ninety days of their absence the two travellers covered a distance of about thirteen hundred miles, the greater part of it being on the inland ice at an elevation of 8000 feet.

Lieutenant Peary then planned an expedition on a larger scale. After crossing the inland ice to Independence Bay three parties were to be formed: one to obtain a supply of musk-ox meat in the neighbourhood; a second to explore the unknown eastern coast down to Cape Bismarck; and a third to advance northwards through the islands he and Astrup had seen on the first journey. Unfortunately, several disasters befell the party at Inglefield Gulf, the worst being that the pemmican turned bad. On the journey, which was commenced on March 15, 1894, violent storms were encountered, the wind for thirty hours blowing with a velocity of forty miles an hour, while the thermometer sank to -60° F. In such weather travelling was impossible, and the party returned. Nor was the third expedition, which set out in the spring of the following year, much more successful. The caches of provisions which had been formed on the inland ice were so deeply covered in snow that they could not be found, and Lieutenant Peary and his coloured man, Hensen, had to start without pemmican, or walrus meat for the dogs. Notwithstanding this drawback, they pushed on with great endurance to Independence Bay, which they reached in a starving condition, and with their team of dogs much reduced. Fortunately they fell in with a herd of musk-oxen immediately on their arrival, several of which they shot, thus obtaining food for both themselves and their dogs. This, however, was the only herd they saw, and after their trying journey the travellers could not venture to extend their journey, but made haste to regain their headquarters while their supplies lasted. The nine dogs with which they commenced the return journey gave in one by one, and the provisions disappeared all too quickly. At a distance of twenty-one miles from the Lodge the last meal was taken, and finally Hensen could march

no farther, so that Lieutenant Peary made the best of his way alone to the Lodge in search of assistance. One dog alone survived.

After this brief outline of his exploits Lieutenant Peary stated his plan for reaching the Pole. Nansen having proved that sea lay to the east, north of Siberia, Franz Josef Land and Spitzbergen, it seemed to the lecturer that the only practicable route lay to the north of Greenland. He proposed to take on board from the neighbourhood of Inglefield Gulf eight families of Eskimo, with their tents, sledges, dogs, and all other movable property. Then he would carry his vessel northwards as far as the ice would allow him, perhaps to Cape May at the entrance of Sherard Osborn fiord, in 82° W. lat., if not beyond. From this base he would, with the aid of the Eskimo, send on a supply of provisions and form a depôt at a distance of thirty to fifty miles. Having moved his party to this depôt, he would repeat the process until the most northerly point of land was reached, from which he would make a dash for the Pole with a large number of dogs and sledges laden as lightly as possible. He allowed a rate of ten miles a day for the march northwards, and should he find the last point of land at about lat. 85 N., or at a distance of some 360 miles from the Pole, he hoped to be able to march there and back in about ten weeks. If the state of the ice prevented his advancing northward one year, he would wait till the next. He trusted much to the co-operation of the Eskimo, a sturdy folk thoroughly inured to the climate, and familiar with the conditions of Arctic travel. As for Europeans, he did not believe that there was any reason why they should not enjoy perfect health for an indefinite time in high latitudes, so that his party might wait from year to year until it found an opportunity of accomplishing its purpose. The small tribe of "Arctic highlanders," inhabiting the coast from Melville Bay to Kane Basin, he regards as peculiarly fitted for the task to be intrusted to them. A hardy people numbering only between 200 and 300, they have lived for centuries in complete isolation, and, before the *Kite* arrived, the men now living had never seen a white man. In stature they are small, but, as was shown by the lantern slides, they are well built and muscular, and are not the shapeless masses of fat that Eskimo are often supposed to be. They are, moreover, intelligent and trustworthy. At the arrival of the American expedition they were living in the greatest poverty. Their weapons and implements were of the rudest, the raw material being scarce and inadequate: thus, the runner of a sledge was made of, perhaps, thirty small pieces of bone and wood laboriously lashed together. Now they have been supplied with planks for their sledges, wood of different kinds, and various articles of hardware, so that they have been raised to a condition which, to them, is one of affluence.

Sir John Ross, in 1818, found these Eskimo in possession of iron implements of their own manufacture, and an analysis of the iron showed that it contained nickel and was probably of meteoric origin. It was reserved for Mr. Peary to discover where the supplies were obtained from, namely, from three huge meteorites on the heights overlooking Melville Bay, which, according to Eskimo tradition, are an Eskimo, his wife and dog, which were cast out of heaven and turned to stone. The large amount

of nickel they contain is a proof of the origin of these blocks. The two smaller Lieutenant Peary managed to get on board his vessel in 1896, and he carried them off to the United States; but the largest, weighing about ninety tons, he could only roll down to the coast. Returning, however, last year, he succeeded in carrying off this meteorite also, the largest that has been discovered.

In the concluding part of his lecture Lieutenant Peary portrayed with the aid of slides the scenery of Greenland, the incidents of a journey to Independence Bay, the Eskimo, their dress, tents, huts, and dogs. The rocky coast of Greenland, with the edge of the inland ice peeping over it, was shown in its summer aspect, by moonlight in the long Arctic night, and in a gathering storm overshadowed by red lowering clouds. The glaciers descending to the fiords in cliffs 150 to 200 feet high, with their deep crevasses; icebergs and crags of fantastic shapes and in different lights; the dreary surface of the inland ice, and the stony moraines that skirt Independence Bay, were also exhibited by means of the lantern. Perhaps of these views the most striking was one of the eclipse at midnight in August 1896, with the rays of the half-hidden sun throwing weird gleams on the sea, while the bold steep coast in the background lay in deep shadow.

The natives were illustrated in a whole series of slides. Their dress was fully portrayed: first, the outer jacket of sealskin, with hood attached, then an under vest of birdskin with the feathers inside, and also provided with a hood, the shirt of deerskin, the bearskin trousers, and the drawers. Lastly, the man himself was shown, small but compactly knit together, with well-developed muscles. The movable tent, the snow hut, and the more permanent erection of stones, were in turn thrown on the screen; and the Eskimo's last resting-place, a cleft in a rock by the shore, before which lay his sledge harnessed to two dogs, which had been strangled at the grave to draw their master in another world. Mr. and Mrs. Peary's little girl, born at Inglefield Gulf, formed a pretty picture in her Eskimo dress.

One more view may be mentioned—that of Lieutenant Peary's house, Anniversary Lodge, at Bowdoin Bay, Inglefield Gulf. It is a long building with the central part of the roof raised so that, through the surrounding clerestory, as much light as possible may be obtained when the sun is low. Around the base runs a corridor which serves as a storehouse for supplies of all kinds, and at the same time helps to raise the temperature of the interior.

Accounts of the earlier work of Mr. Peary and his companions have been given by Mrs. Peary in her *Arctic Journal*, by Dr. Keeley in his *In Arctic Seas*, and by Professor Heilprin, who commanded the relief expedition which met Peary and Astrup a few miles from the coast on their return from the first trip to Independence Bay, in his *Arctic Problem*, and in *Blandt Nordpolens Naboer*, written by E. Astrup. A work by Lieutenant Peary himself will shortly be published, in which, besides the narrative of his later expeditions, the scientific results will, no doubt, be set forth in fuller detail than they have as yet appeared in geographical publications.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting held on December 20th, special Silver Medals were awarded to Lieut. Peary, U.S.N., and Dr. Sven Hedin for their services to geography.

The following ladies and gentlemen were elected Members of the Society :—

Ainslie, Mrs. Scott.
Bartholomew, Mrs. J. G.
Bowes, Mrs.
Clapperton, Miss M. A.
Crookshank, Miss M. H.
Hamilton, Mrs. T. F.
Nairn, Miss M.
Small, Miss C.
Smith, Mrs. C.
Walker, Mrs.
Abernethy, D. W.
Beattie, W. Halden.
Beddow, A. W.
Bisset, John.
Blackie, J. R.
Brown, Rev. J. C.
Cairns, John.
Callender, W. C.
Campbell, Arch.
Coghill, William C.
Cox, C. T.
Cranstoun, J. Y. T., of Dewar.
Cresswell, Henry L.
Edward, David.
Gilchrist, George.
Giles, Rev. Alexander, M.A.
Guild, G. T., M.B., C.M.
Heggie, Robert, Jun.
Henderson, William.
Hendry, J. M.
Kyd, J. N.
Leslie, P. W.
Lindberg, O. M.
Macdonald, Peter.
MacIntyre, Ian.
M'Lauchlan, J. J.
M'Neil, Allan.
Mitchell, William.
Morgan, Rev. J.
Playfair, John, M.D.
Readman, J. B., D.Sc.
Richardson, J. C. B.
Robertson, A. C.
Russell, George.
Steven, Robert.
Tornöe, J. W.
Turnbull, Robert, B.Sc.
Wallace, William.
Watson, James.
Wedderburn, J. R. M'L., M.A.
Williamson, Charles, M.A.
Wyllie, Alexander.
Yule, Charles.

—In all fifty-three.

Colonel Dods was added to the Lecture and Education Committee, Mr. A. J. Herbertson to the Education and Publication Committees, Mr. J. B. Sutherland to the Lecture Committee, and Professor Prothero to the Publications Committee.

Lectures delivered in December.

On Friday, December 3rd, Dr. Sven Hedin gave an address in Edinburgh on his "Four Years' Exploration in Central Asia." Sheriff W. C. Smith presided.

Dr. Hedin also addressed the Glasgow Branch on December 6th, when Mr. John Stephen presided; and delivered a lecture in Aberdeen on December 4th, Mr. James Spence occupying the Chair; Mr. John Clarke proposed the vote of thanks.

A large meeting was held in the U.P. Synod Hall, Edinburgh, on December 10th, to hear an address from Lieut. Peary, U.S.N. Dr. John Murray took the Chair.

Lieut. Peary visited Dundee the next day and lectured (at 12 noon) to the

Dundee Branch of the Society. Lord Provost M'Grady presided, and Mr. I. J. Weinberg proposed a vote of thanks to the lecturer.

In reply to an invitation to address the Branches in Glasgow and Aberdeen, Lieut. Peary wrote to the Secretary :—"Nothing would have given me greater pleasure, if I had been master of my own time. But, as I must return to New York without delay, I regret I cannot address any meeting in Scotland except in Edinburgh and Dundee. Pray express my deep regret to your Branches at Glasgow and Aberdeen."

Mr. Alfred E. Pease, M.P., described British Somaliland, its inhabitants and its game, in the Society's Hall, Edinburgh, on December 16th. Colonel J. M. Trotter presided.

Lecture in January.

Mr. F. G. Jackson, leader of the Jackson-Harmsworth Expedition, will lecture in Edinburgh on January 25th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Loch Fyne.—In 1896 Dr. H. R. Mill investigated the currents of Loch Fyne. An account of the work done, with tables of observations, is published in the Fifteenth Annual Report of the Fishery Board for Scotland, where the general results are thus stated :—"The flood-tide brings in water from the upper and deeper layers of the Arran Basin, which is thoroughly mixed in passing Otter Spit before high-water, and fills the Gortans Basin with a nearly homothermic mass, which is passed on through the Minard Narrows into the Upper Basin, where it does not sink through the cold deep water in summer, but only mixes with the upper layers above twenty fathoms, becoming more superficial in its effects as the tide passes upwards. In the ebb there is, at the upper end of the loch, only a superficial movement, but at the platform between Furnace and Minard the rush of the surface current into the Gortans Basin, while it is strongest at half-ebb, draws up the deep cold layers to a slight extent, causing a slight mixture with the warmer water. The homothermic mass pours out into the Arran Basin, acting on the ebb probably in the same way as at Furnace on the flood. Thus, there is always in progress a gentle mingling of the deep waters of the two deep basins, through the intermediate shallow basin. The rapid surface current of the ebb carries out the excess of fresh water from the Arran Basin, while the small underflow from the Arran Basin passes in water of higher salinity with the flood. This circulation is liable to be accelerated or checked by the influence of wind."

The Dortmund and Ems Canal.—The ever-increasing output of coal in the mines of the Ruhr basin, and the fact that in spite of the increased sale of Westphalian coal in Hamburg the importation of English coal has not diminished, have prompted the German Government to take in hand the construction of a canal which will afford a cheap means of transport to the harbours on the Ems ; and a commission was appointed in 1889. Beginning at Dortmund, the canal will be connected near Bevergern with the inland canal which will run through Osnabrück, Hanover, and

Oebisfelde to the Elbe, and, occupying the bed of the Ems for a short distance, will take up the already existing Ems canal, entering the river again at Meppen. At Oldersum a branch will diverge to Emden. The total length of the canal will be 168 miles; its breadth, 98½ feet at the surface of the water, and 59 feet at the bottom; and its depth will be 8 feet.

ASIA.

Ancient Map of Syria and Egypt.—In December 1896 a remarkable map was discovered in Madeba, east of the Dead Sea, the famous capital of the Moabites. In a church built on the ruins of an old Christian basilica are the remains of an artistically executed mosaic pavement, which represents cartographically Syria, Palestine, and Egypt, and evidently dates from the end of the fourth, or, at the latest, the beginning of the fifth, century. Originally it covered the whole floor of the basilica (fully 3000 square feet), but only some 190 square feet still remain. A few years ago the names Smyrna and Ephesus were legible near the door of the church, so that Asia Minor was included in the map. Its importance is very great to geography and history as well as to archæology, for towns hitherto unknown are marked upon it, and the positions of others are clearly indicated. Many details also are given not usually to be found on maps, as the size and plan of every important town, which is likewise portrayed in natural colours, the number and situation of its gates, its chief buildings, its old and its popular name, etc.; and all the natural features of the country are noted, even to palms and bananas. A copy will shortly be printed in Germany.—*Deutsche Rundschau*, Jahrg. xx. Heft 2.

Lake Baikal.—M. F. K. Drizhenko read before the Russian Geographical Society in April last (*Izvestiya*, No. 2, 1897) a report of the work he executed on Lake Baikal during 1896. He was commissioned by the Minister of Routes of Communication to make himself acquainted with the conditions of navigation, and with the facilities for executing hydrographical observations; to determine roughly the parts of the lake where soundings were necessary for the benefit of navigation, both by boats and larger vessels, and those where only hydrographical research in deep water need be carried out, and at the same time to note those parts of the shore where surveys of more or less exactness would be advisable, where triangulation surveys might be executed without much trouble, or where points might be fixed astronomically; to make astronomical observations for the determination of the co-ordinates of some points on the shore, and to engage in magnetic, meteorological, and hydrographical research; and to establish posts for hydrographical measurements combined with simple meteorological records.

Arriving in Irkutsk in the beginning of June, M. Drizhenko obtained all the information, maps, etc., available, and embarked on the steamer *Innocentia*, which, with its crew of twenty-four men, was placed at his disposal. He first crossed to Mysovaia and then followed the eastern shore, passed the mouth of the river Barguzin, and, rounding the peninsula of the Sviatoi Noss, came to anchor in the Krugulik bay, between the peninsula and the shore of the lake. The peninsula is occupied by a lofty mountain range, with bare summits, running in the direction of its axis. The bay contains a number of secondary indentations, promising good anchorage. Fishing is here an important occupation, the species caught being salmon and gwyniad (*Coregonus*). One of the party shot a dark-gray bear; these bears are somewhat numerous, being attracted by the fish offal. After examining the indentations of the shore, and taking soundings as far as Cape Pokoinki on the western bank, and astronomical observations, the expedition continued its voyage northwards to the mouth of the Upper Angara at the extremity

of the lake, where also Russian fishing-boats resort in summer. While staying at the western mouth, the Dushkachan, M. Drizhenko made an excursion to the Toshkia river and the important gold mines of Alexandrof and Nikolaievsk, about four miles farther, for the purpose of establishing a meteorological station. On July 19th the *Innocentia* started on its journey along the western shore, and experienced very bad weather as far as Cape Pokoinki. When the storm abated a little the outline of the coast could be seen, but it was impossible to take photographs along this most picturesque part of the Baikal lake. The entrance to the Maloie More was sounded, and, the steamer passing round the Olkhon island, the southern entrance was also examined, and found to have a breadth of fully two and a half miles, with a depth of twenty-three fathoms. The bottom of the Maloie More rises towards the south, and opposite the river Sarma shallows to one and a half fathoms.

Having called at Listvenichnoie for supplies, the expedition proceeded to examine the southern end of the lake, where very few anchorage grounds were found, the mountains approaching close to the lake and often sloping steeply to the bottom, and then sailed again to Olkhon island.

The basin of the lake is an enormous hollow, with extraordinary depths frequently beginning close to the shore, and occupying a very large proportion of its extent. At about a third of its length from the south-western extremity, the basin is divided into two unequal parts by a ridge formed by the alluvium of the river Selenga, and partly by that of the Buguldeika. This ridge attains its greatest depth, 234 fathoms, near the latter river. The maximum depth measured in the southern basin by the engineer Bogoslovski was 791 fathoms, and lines of soundings carried across it in the seventies by Dybovski and Godlevski show that the greatest depths occur near the shores, except near the Posolski monastery, where 100 fathoms were measured at a distance of four and a half miles from the shore, while in the middle, between the monastery and the mouth of the Goloustnaia river, the bottom rises to thirty-three fathoms. In 1896 a rise to twenty-six fathoms was found, fifteen miles farther to the north-east. Whether the line from the southern extremity of Sviatoi Noss to the northern end of the Olkhon island forms another division, the examination of the middle part of the lake is too incomplete to show. In general very great depths were found here, the maximum, near the Sviatoi Noss, being 622 fathoms. A depth of 670 fathoms was measured this year near the Olkhon Vorota, the southern entrance to the Maloie More—probably the maximum for the upper part of the lake. The northern part, though also deep, is considerably shallower than the lower portion, the soundings along a line about three miles from the Angara not exceeding 493 fathoms.

Though the water is, as a rule, deep near the shore, yet there are considerable areas where it is shallower than thirty fathoms, as, for instance, along the delta of the Selenga, in the Krugulik (or Chivirkuisk) bay, round the delta of the Upper Angara, and in the Maloie More. These areas occupy about 1100 sq. miles, or only eight per cent. of the whole surface.

From the temperature observations it appears that the rivers Selenga, Buguldeika, and Upper Angara, as well as the Maloie More, and Chivirkuisk bay, show a marked tendency to high temperatures; in the bay water as warm as 67° F. was found to a depth of four fathoms, at the mouth of the Selenga and of the Angara the mean surface temperature was 56°·3, while at the northern extremity of Olkhon it was 46°·9, and in the middle of the lake it varied from 38°·1 to 38°·7, remaining constant to the bottom. In general the water is warmer near the shore than in the middle, and in the southern part of the lake than in the

northern, and the temperature rises towards the end of summer. The mean monthly temperature of the air was 51°·8 in June, 54°·5 in July, and 56°·5 in August.

Lake Baikal, occupying an enormous area of fully 13,000 sq. miles, stretches to a length of 400 miles, with a small breadth varying from eighteen to twenty-three miles, and affords an excellent natural channel of communication between the adjacent localities deprived of any other highway. There are, indeed, near the shores of the lake paths that may be followed on foot, and some of them on horseback, but for the most part they are known only to the wandering strangers who visit the country to hunt for furs. The lake has from time immemorial served as a highway. At the end of last century, and down to the middle of the present, a flotilla of sailing vessels under military control maintained the postal service, facing the storms of the lake, though wretchedly built and equipped; and their type is still preserved. Their usual end was to be driven ashore by the wind. With the introduction of steam the navigation was improved, and will probably be considerably developed in the future.

The coasts of the lake contain natural wealth of several kinds—minerals, timber, cattle, fur-bearing animals, medicinal mineral waters. Fish are plentiful, giving occupation to fishermen and traders, while the position of the lake on the great commercial route from Europe to Eastern Siberia and China gives a constant stimulus to shipping. At present the shipping is entirely in the hands of the Niemchinof company, which owns ten steamers and a considerable number of barges, and carries the mails three times a week between Listvenichnoie and Mysovaia, and three times during the summer to the Upper Angara. Besides these vessels, there are some steam fishing-boats on the lake.

Good mooring grounds are scarce. There are harbours only at Chivirkuisk, Mysovaia, and Klinevka, and there are completely sheltered bays in the Chivirkuisk gulf, the Olkhon Vorota, at the island Buguchan, and at Cape Zavorotnyi. Elsewhere the best roadsteads are only places near the shore where the ground is good and the water not too deep. Consequently, navigation on Baikal is risky, and its existence is due to the necessity of making use of the lake in the absence of other ways of communication, and to the large profits obtained. Further difficulty and risk are encountered in the winter half of the year from the ice, to obviate which an ice-breaker will be placed on the lake, measuring 290 feet in length by 57 broad, having a capacity of 4200 tons displacement, and machines of 3750 indicated horse-power, which with three screws will develop a speed of thirteen knots. It will convey a train of twenty-five goods wagons between Listvenichnoie and Mysovaia, and will be able to contend with ice over three feet thick. In its contours it resembles the *Fram*, and has no rival in its class of vessel. The conveyance of this monster in sections weighing about twenty tons each from London to Lake Baikal, 660 miles of the distance by road, is itself a gigantic undertaking.

A map of the lake is urgently needed, and will be the more necessary when, the railway being completed round the south-western end of the lake, the ice-breaker can keep communication open with the other parts of the lake. The route to the Upper Angara is of especial importance on account of the gold mines already mentioned, and the fishing industry. By this river it may also be possible to reach the rich Vitim mines.

AFRICA.

Togoland.—By a treaty between France and Germany, signed at Paris on July 7th, the colony of Togo is enclosed on all sides by fixed limits. Leaving the coast

on the meridian of the island of Bayol, the boundary follows this meridian to the south bank of the lagoon, along which it runs as far as a point about 100 yards east of the eastern point of Bayol. Then it proceeds due north till it strikes the middle line of the lagoon, which it follows to the Mono, which forms the boundary up to 7° N. lat. Then it returns along the same parallel to the meridian of Bayol, which it follows northwards as far as the parallel bisecting the distance between Bassila and Penesoulou. Thence it makes for the river Kara along a line equidistant from the road from Bassila to Bafilo through Kirikri on the one side, and the road from Penesoulou through Aledjo to Semere on the other side. After descending the Kara for about three miles, it runs northwards to 10° N. lat., leaving Semere in French territory. From the 10th parallel the frontier takes a straight course to a point on the Dje-Gandou road equidistant from these places, and thence to the 11th parallel keeps at a distance of about nineteen miles from the road between Sansanne-Mango and Pama. The northern boundary is formed by the 11th parallel as far west as the White Volta. Then, descending this river to the 10th parallel the frontier follows the latter to its intersection with the parallel of 1° 32′ W. lat.

In the west the partition of the neutral zone between Salaga and Jendi has yet to be settled by an agreement with Great Britain.

The area of Togoland, according to a planimetric measurement made by Dr. H. Haack, will henceforth be 31,770 square miles.—*Petermanns Mitt.*, Bd. xliii. No. 11.

Discovery of a Lake in Cameroons.—Lieut. Freiherr von Stein, being in the spring of 1896 in command of the Edea station, on the southern bank of the Sannaga in lat. 3° 48′ 20″ and long. 10° 6′ E. about, had occasion to descend the river, and found that a tributary entering the Sannaga six to nine miles below Edea had its origin in a large sheet of water, of the existence of which reports had already reached his ears. Just below the mouth of the tributary the Sannaga forces its way through a range of hills 100 to 160 feet high, and on this account, as well as for other reasons, it has been assumed that it formerly reached the Cameroons estuary through the Ndonga creek or the Lungasi river. Believing that he had now found the head of the old channel of the river, and desirous of tracing a navigable connection between Edea and Cameroons in place of the longer route through the Kwakwa, which, moreover, is scarcely passable in the dry season, Lieut. von Stein determined to explore every corner of the lake, and investigate its depths, currents, etc. He failed, however, to discover any channel running in the required direction.

The passage from the Sannaga into the lake is very winding, narrow, and much encumbered by trunks and overhanging vegetation. It is, however, deep, the minimum, close to the Sannaga, being nearly ten feet, so that, were the obstructions removed, it would be navigable by the boats used on the Sannaga. The lake, called by the natives Ossa, seen from the lower end is very picturesque. The southern part is a large expanse of open water, while towards the north and east appears a confusion of islands and peninsulas. On the south and south-east the banks are low, whereas on the other sides they rise into summits and ridges 70 to 160 feet high. The bed-rock is everywhere gneiss, which is covered with a layer of laterite varying in thickness. This is the only place in the country where hippopotami are still to be found in fairly large numbers. The waterbirds also are numerous, and Lieut. von Stein collected several which, to him at least, were quite new. Judging from the spoor, he concluded that elephants, wild boars, antelopes and monkeys were plentiful, so that the neighbourhood of the lake must

be a good hunting ground. The water swarms with fish, and temporary huts, fireplaces, and other signs of fishermen were frequently noticed. There is no permanent population, and hence the abundance of animal life.

Measurements on the map show the extreme length of the lake to be nearly twelve miles, while the maximum breadth of the southern part is about five and a half. The dimensions are not stated in Lieut. von Stein's article in the *Mitt. aus den Deutschen Schutzgebieten*, Bd. x. Heft 3.

AMERICA.

The Yukon District.—Dr. George M. Dawson, Director of the Canadian Geological Survey, has expressed the following opinion of the future of the Yukon district to a *Daily Chronicle* interviewer :—

"The placer mining now fairly begun on the Klondike is likely to continue for a number of years, the maximum output being attained probably next year or the year after. Meanwhile the whole country will be filled with prospectors, and although it is not probable that many more streams as rich as the Klondike will be found, the very general distribution of fine gold along the rivers of the whole district, with the geological structure of the country, so far as it is known, go to show that other rich placer mining districts will undoubtedly be discovered. Each of these will have a similar history, but in the meantime quartz mining will be developed, the conditions will become more settled, and agriculture, such as the climate admits of, will be prosecuted to such an extent as may be called for by local requirements. A considerable population will become resident in the Yukon district, and railways will be provided to connect it with the Canadian system. Another important result which will flow from the opening up of this district will be the early development of the mineral resources of the whole belt of country, hundreds of miles in length, which lies between it and the southern part of British Columbia."

Mr. William Ogilvie, the Dominion Surveyor in the Yukon District, has been summoned to advise the Government about the situation in the gold-fields. His reports leave no doubt about the extraordinary riches of the Klondike gold region. The gold zone extends 500 miles; a little is in Alaska, but most in the Yukon district or in British Columbia. The quartz is said to be inexhaustible, and Mr. Ogilvie found some yielding £200 per ton. Mr. Ogilvie says that the name which has hitherto been spelt *Klondike* on official maps, will in future be spelt *Koandik*.

The Jesup Expedition in British Columbia.—The expedition announced on p. 271 of vol. xiii. began its work last summer in British Columbia. The party consisted of Dr. Franz Boas, Dr. Livingston Farrand, and Mr. Harlan I. Smith. A committee of the British Association has for several years carried on ethnographical investigations in the North-Western territories, and it seemed advisable that the operations of both parties should be conducted on a common plan. Accordingly, Dr. Farrand undertook the study of the Chilcotin for the British Association, and afterwards inquired into the sociology of the northern Kwakiutl. Mr. Smith investigated archæological remains at Kamloops, Spence's Bridge, at the famous burial ground at Lytton, and at Port Hammond. The utensils found at Kamloops belong to a period preceding contact with white men, and suggest that the people using them were the immediate ancestors of the tribes now living in the neighbourhood. At Lytton and Port Hammond the remains were of a very similar character.

Dr. Boas obtained some interesting information regarding the Bella Coola,

the only tribe that has systematised its mythology. They believe that there are five worlds, an upper heaven, over which the supreme goddess Qamaits rules, and a lower heaven in which dwell a number of deities, the most powerful being the sun. The traditions of the tribe are, to a great extent, totemic. Only members of a clan have the right to relate their traditions and use the tribal carvings. This has led to the custom of endogamic marriage, to prevent the acquisition of these rights by members of other clans, but the system is breaking down under the influence of the Kwakiutl, among whom exogamic marriage prevails.

The mythology and customs of the Chilcotin are shown by Dr. Farrand to afford striking evidence of the influence of neighbouring tribes. This people has no clan organisation. Their general condition and habits have greatly changed within the last thirty years, owing to the establishment of reservations on which most of the tribe have now settled down. As to the social organisation of the Heiltsuk, it was found that the tribe contains four clans—the eagle, wolf, raven, and killer whale. The individual clans are strictly exogamous. Descent is mixed, maternal and paternal, but preference is shown to the clan of the mother. Formerly there were three classes—nobility, common people, and slaves. A member of the lower classes could never rise into the ranks of the nobility.

A large collection has been made of casts and photographs of the Indians, of their masks and carvings and artistic productions, and of archæological remains at the places already mentioned, and it is hoped that the work of the expedition will help to solve many difficult problems regarding the early history of mankind.—*Science*, Oct. 8th.

Popocatepetl and Ixtaccihuatl.—Dr. Oliver Farrington of the Field Columbian Museum has issued a pamphlet on these peaks, wherein he has made use of the observations of former travellers as well as of those made by himself during a recent visit to Mexico. The mountains under consideration are the highest points of the Sierra Nevada of Ahualco, lying 35 to 50 miles east of the city of Mexico. Rising out of the plains of Apam in the north, the sierra gradually increases in height up to its culminating point, Popocatepetl, and then descends sharply to the plateau. It separates the valley of Mexico from that of Puebla; the shortest line of communication between the valleys is over a saddle 12,118 feet above sea-level, which lies between Popocatepetl and Ixtaccihuatl.

Though topographically connected, the two mountains lie, according to Felix and Lenk, on two different lines of fissure. Popocatepetl stands on a line of fissure running east and west, with which are connected the volcanoes Ajusco, Toluca, and Patzcuaro, while Ixtaccihuatl, Telapon, and Tlamacas rise above a line of fissure at right angles to the former. Popocatepetl stands at the junction of the lines, and hence, perhaps, its greater size and activity. The eruptions which built up these elevations took place, according to some authorities, at the close of the Mesozoic period, while by others they are ascribed to Miocene times. At any rate man was living at the time the outflow took place, as is proved by bones and fragments of pottery lying underneath the lava. The rock of this outflow is plagioclase basalt. The lava and débris dammed up sections of the country, and lakes were thus formed, around which wandered large mammals. The remains of the camel, bison, llama, elephant, and horse have been found, and two complete skeletons of glyptodon.

Popocatepetl, the smoking mountain, is by Sonntag's measurement 19,539 feet high, and is, accordingly, the fourth summit of North America, next to Mt. Logan, Mt. St. Elias, and Orizaba. Seen from the west it appears as a symmetrical, rounded, snow-capped cone rising about 5000 feet above the ridge of the sierra. The average slope of the cone is about thirty degrees. Towards the south its aspect

is still more imposing, for it rises directly from the plain to a height of 13,000 feet. The crater edge is highest on the western side, so that the western wall can be clearly seen in fine weather from the valley of Puebla. Successive flows of lava have given Popocatepetl a stratified appearance, and the character of the layers mark, according to Aguilera and Ordoñez, a gradual decrease in the heat and energy of the volcano. The lower deposits are basalts containing a large amount of olivine, while the upper are hypersthenic andesites. The authors just mentioned believe that three periods are indicated by the deposits, those, namely, of lava, breccia, and ash eruptions; but probably the change from lavas to breccias, and breccias to ashes, was frequently repeated. In modern times the activity of Popocatepetl has been confined to the emission of steam and sulphur from the crater.

Dr. Farrington made the ascent of the mountain in February 1896. Looking down into the crater from the ridge of ashes which forms its lip, he saw a pit about 2000 feet by 1300 feet and 800 to 1500 feet in depth. Jets of steam issue hissing from the nearly perpendicular walls, and rocks are continually falling to the bottom. Aguilera and Ordoñez found that the height from the Pico Mayor, the highest point of the ridge, to the little lake at the bottom of the crater was 1657 feet, while from the Malacate (a windlass rigged up to let down the sulphur miners) it is only 673. The rents in the crater walls often vary in number; at the time of Dr. Farrington's visit there were six. Besides steam, they eject hydrogen sulphide and sulphurous acid, which combine to form sulphuric acid and sulphur.

On the north-west side of the principal cone stands the Pico del Fraile, rising to a height only 1000 feet less than that of the cone itself. Its general appearance gives the impression at first sight of an old crater, three-quarters of which have vanished; but the Mexican geologists now regard it as an isolated portion of the main crater. Should it date from an earlier period than the main crater, they prefer to connect it with a similar elevation on the south-eastern side, and regard the two as fragments of an earlier crater, corresponding to the Monte Somma of Vesuvius.

Ixtaccihuatl lies nearly due north of Popocatepetl, at a distance of about ten miles. In shape it is very different, consisting of a long narrow ridge cut into three peaks, the central being the highest. The snow-covered portion has a striking resemblance to the figure of a woman lying on her back, and hence the name Ixtaccihuatl (White Woman).

The Mexicans of old seem to have been totally unacquainted with its flanks, and it was only in 1889 that the first well-authenticated ascent was made by Mr. James de Salis, who was followed five days later by Mr. H. R. Whitehouse. The height of Ixtaccihuatl is still very uncertain; Humboldt and Lenk assign to it less than 16,000 feet, while according to Heilprin and Sonntag it is fully 17,000. It is usually spoken of as a volcano, though many writers maintain that the term is incorrectly applied to it. The areas of volcanic sand on the mountain may have been blown over from Popocatepetl, while the elongated form, the absence of any well-defined crater, and the homogeneous texture of the rocks suggest that it never was a true volcano and may possibly have originated in a fissure eruption. The rock of which it is composed is amphibole-andesite, a rock differing completely in character from those of Popocatepetl. The flora is more abundant and varied than is found on the latter mountain, owing probably to the greater fertility of the soil and more abundant water.

Like Popocatepetl, the upper part of the mountain is covered with snow, which descends on an average 2000 feet below the summit of the mountain. On the former, however, there are no hollows where ice and snow can accumulate, whereas the upper part of Ixtaccihuatl is furrowed by several deep valleys which favour the formation of glaciers. There is certainly one true glacier on the north-western

side, lying between the central and southern peaks. It was named by Heilprin the Porfirio Diaz glacier. This glacier at one time undoubtedly reached much farther down the mountain, as is proved by the presence of polished and striated rocks. Packard believes that the mountains must have been covered with glaciers descending to a line 9000 feet above the sea, or 1000 above the level of the plains, and infers that ice must have filled the pass between Popocatepetl and Ixtaccihuatl and sent down glaciers to the lakes then covering the plains of Anahuac. Dr. Farrington's observations led him to the conclusion that while the extent of the glaciers was much greater than at present, there was no vast *mer de glace* such as Packard describes.

The Republic of Central America.—A copy of the treaty of union signed on June 15th by the representatives of the five Central American republics—Guatemala, Costa Rica, Nicaragua, Honduras, and Salvador—has been received at Washington. This treaty became effective on September 15th. The new federation is called the Republic of Central America, and the countries forming it will, under the treaty, take the name of States. The government is to be carried on by a council consisting of two representatives from each State and a chief of State, the latter selected from each of the States in rotation, and to hold office for one year. Alliances for defence and preservation for all the States are provided for, and the expenses of government and of war are to be assessed by the council.

The Area of Peru.—Señor Meliton Carvajal has executed a planimetric measurement of the area of the Republic on Raimondi's map, the limit of instrumental error being within a twenty-thousandth. The results for each province and department are given in the *Bol. de la Soc. Geogr. de Lima*, Tom. vi. Trim. 2, and the density of population is added. The whole country has an area of 695,897 square miles and a density of 6·7 persons to the square mile. This, however, does not include the area of Lake Titicaca within the Peruvian boundary, which amounts to 1714 square miles, or the islands in the Pacific which have an aggregate superficies of 12½ square miles. The area obtained by Señor Carvajal does not differ much from the mean of those obtained by Señor Paz-Soldán and Dr. F. Villareal. How the figures for density of population are obtained Señor Carvajal promises to explain in another article. Here he merely points out how large an area is still almost desolate, having less than one inhabitant to a square kilomètre. 218,435 may be styled populous districts, having an average density of 20·7 to the square mile, while the remaining 477,462 square miles have only one inhabitant to about 6⅙ miles.

MISCELLANEOUS.

We regret that we omitted to acknowledge in our last number the kindness of the **British Astronomical Association** in lending us the block for the map on p. 651. vol. xiii.

A useful pamphlet on the **Yukon District** is issued from the office of the High Commissioner for Canada. It contains excerpts from reports of Dr. Dawson and Mr. Ogilvie of the latest date, sketch maps of the Klondike district and the routes thither, mining regulations, etc.

Mr. A. J. Herbertson will deliver, in the Outlook Tower, a course of ten lectures on **Modern Views in Geography**, beginning on Saturday, January 29th, at 10.30 A.M. In these lectures an outline of the most recent ideas will be given, more particularly in the domain of physical geography. Practical work in laboratory, library, and field will be carried out in connection with the lectures.

A long programme has been issued of the festivities to be held this year in Portugal in commemoration of **Vasco da Gama's** voyage to India. At first fixed for July 8th, 1897, the fourth centenary of the departure of the expedition from Lisbon, the celebration is now to take place at the anniversary of the arrival of Vasco da Gama in Calicut, and the 17th to 20th May have been proclaimed as general holidays.

The sixth series, fourth part, of the *Bijdragen tot de Taal- Land- en Volkenkunde van Nederlandsch-Indie* consists of the first instalment of a work entitled **De Nederlanders in China** by W. P. Groeneveldt. It narrates the efforts made by the Dutch during the years 1601-1624 to open up trade with China, and their occupation of the Pescadores. The work is compiled from original sources, and is a valuable contribution to the history of commerce.

In 1897 the *Princesse Alice* executed soundings down to 1216 fathoms off the coast of Morocco between Rabat and Saffi, and down to 2384 fathoms between the coast and Madeira. Before reaching the Azores the Monaco deep was visited, and soundings of 3023 and 2974 fathoms were taken. The bank discovered the previous year near the Azores was more thoroughly examined, with the result that its area was found to extend between 29° 7′ and 29° 25′ W. long., and between 37° 48′ and 38° N. lat.

De Agostini, who has published a monograph on the Orta lake, has this summer been engaged in the investigation of the volcanic **Lakes of Latium**, of the depth of which nothing exact has hitherto been known. 3000 soundings were taken, and the Bolsena lake, fourty-four sq. miles in area, proved to have a maximum depth of 479 feet, while the lake of Mazzano, to the west of it, sinks to a depth of 102 feet. The bottom temperature of the Bolsena lake was constant at 44·8° F. —*Geogr. Zeitschrift*, Jahrg. iii. Heft 11.

On September 18th was opened the **Solmona-Isernia Railway**, which is connected at Cajanello with the line from Rome to Naples, and places the fastnesses of the Abruzzo in direct communication with the latter city. Eighty miles in length, the new line follows a winding course, and crosses the Apennines by numerous tunnels, bridges, and viaducts. The longest, through Monte Totile, is 3400 yards long, while the Maiella tunnel, 2717 yards, is the highest in the Apennines, 4123 feet above sea-level.—*L'Universo*, Oct. 15th.

The *National Geographic Magazine* for October last contains a paper on **Geographical Research in the United States**, by Gardiner G. Hubbard and Marcus Baker, U.S. Geological Survey. After a brief introduction on early exploration, the work accomplished by the General Land Office, the Coast and Geodetic Survey, the Engineer Corps, the Geological Survey, the Navy Department, and the Weather Bureau, is described under these headings. In the same number a fuller account is given of the geographic work of the U.S. Coast and Geodetic Survey by Professor T. C. Mendenhall and Otto H. Tittmann.

A New Geographical Society, established through the exertions of Mr. T. G. Rooper and others, at Southampton, was inaugurated by an opening address from Sir Clements Markham, on November 16th. Working in close harmony with the Chamber of Commerce, it will devote especial attention to the commercial aspects of geography, and it will also endeavour to further the interests of education, chiefly by assisting secondary schools in which scholars are preparing for the commercial certificate of the Associated Chambers of Commerce. A library will be collected, principally with a view to supplying information respecting the British

Empire, and a collection of maps and lantern slides for loan will be acquired.—*Geogr. Journal*, December.

An ascent of **Mt. Morrison**, Formosa, was reported in vol. xiii. p. 270. A fuller report is given in *Globus*, vol. lxxii. No. 20, from which we learn that the leader of the party was Dr. Seiroku Honda, professor of forestry in Tokio. The mountain is composed of clay-slates and quartz, and is not of volcanic origin, though springs at a temperature of 168° F. occur on its flanks. The height of the summit above sea-level is 14,350 feet. No snow was seen. Up to 1600 feet grows a tropical vegetation of figs, *Pandanus*, palms, and pineapples; above this, up to 5900 feet, extends a sub-tropical forest, containing camphor-trees. Here begins the coniferous zone, with *Cryptomeria* and *Chamæcyparis* on the lower parts, pine (*Picea Glehni*) from 6900 to 8500 feet, *Tsuga diversifolia* up to 9800 feet, and firs (*Abies Mariesii*) and juniper up to the summit. The mountain abounds in water, and large streams flow down from it.

The U.S. Board on Geographic Names has lately decided on the forms of the names of certain rivers and lakes lately brought into prominence by the gold discoveries in the **Yukon district**. It has adopted the form *Klondike* out of the many varieties that have been used. It restores the name *Lebarge* for one of the lakes of the Upper Yukon, which has of late frequently appeared as Labarge. *Lindeman* is chosen as the name of another lake, sometimes erroneously spelt Lindemann and Linderman. *Lewes* is the correct name for the river often miscalled Lewis, and *Taiya* is adopted for the inlet, river and village now frequently appearing in newspapers under the form Dyea. *Teslin* is given as the name of the lake and river variously called Hootalinqua, Teslinhuia, Teslintoo, etc.; the terminations "huia" and "too" are said to mean river in different Indian dialects. Lastly, the Indian village on the Middle Yukon is to be called *Miklukayet*; it has been written in several forms, including Tuklukyet.—*Science*, Oct. 15th.

NEW BOOKS.

Nippur; or, Explorations and Adventures on the Euphrates. The Narrative of the University of Pennsylvania Expedition to Babylonia in the Years 1888-1890. By JOHN PUNNETT PETERS, Ph.D., Sc.D., D.D., Director of the Expedition. Two vols. New York and London: G. P. Putnam's Sons, 1897. *Price* 25*s.*

We fear that our readers, like ourselves, will be much disappointed with the first volume of this book. It is a record of failure, and the record is wearisome and monotonous in the extreme. The object of the expedition was to excavate and explore Nippur, a city of Babylonia, containing the remains of a temple of Bel, said to be the oldest temple in the world; and, toiling through an often dreary narrative of 293 pages, we do not reach Nippur till page 230. The writer has padded the book unmercifully, inflicting on his readers even the hours of the day when he passed insignificant villages or crossed disused canals. Take, for example, page 143. Here we find details as follow:—"We arose at 1.30 and started on our day's march at 3.10. At 8 o'clock we found ourselves again in the narrow valley of the river. . . . At 8.10 we passed a mosque and the ruins of a village. . . . At 8.35, at a sharp bend of the river, we came upon the Island of Azarieh. . . . It was 9.20 when we began to enter the town," and so on. It was Macaulay, if we

remember aright, who complained of Orme, the historian of India, that he had devoted on an average a whole quarto page to the events of forty-eight hours. We might with justice bring a similar complaint against Dr. Peters, especially as the expedition is now an old story.

We have, to begin with, a fairly interesting account of the genesis of the expedition, which dates back as far as a meeting of the American Oriental Society in New Haven in 1884. It was not, however, till three years after that that the project of organising an expedition to Babylonia was actively taken in hand and made over to the University of Pennsylvania for the purposes of direction. So long as the work of organisation, etc., was carried on in America it was comparatively easy and satisfactory, and the necessary funds were readily subscribed; but when the scene of action was transferred to Constantinople, and questions arose as to choice of sites for excavation, the share the Ottoman Government was to receive of the objects excavated, the wording of the firman under which the expedition was to proceed, and the like, then the members of the expedition had their first experience of Oriental intrigues, delays, and obstructions, which at one time seemed likely to prevent the expedition going farther than the Bosporus. But with the assistance of the representatives of the American Foreign Office at Constantinople, the difficulties raised by the Turkish officials were smoothed over, though the conditions exacted from the excavators were exceedingly onerous. One, for example, was that all articles excavated were to belong to the Turkish Government, but such of them as were not wanted for the Imperial Ottoman Museum might be sold to the expedition for the University of Pennsylvania.

The party reached Alexandretta or Iskanderoon on the 8th December 1888, and after disobeying and evading the regulations of the Custom House by importing fire-arms, they proceeded on their march to Baghdad *viâ* Aleppo and the Euphrates. The greater part of the volume is filled with accounts of the daily march and inspections of ruins on the road, which had been already travelled by many an explorer, not to speak of warriors and conquerors. "Niffer," says Dr. Peters, "as it is ordinarily written; Nufar as I heard it from the Arabs; ancient Nippur lies on the north-eastern edge of the territory of the Affek or Affech Arabs, between the Tigris and the Euphrates, about one hundred miles east of south from Baghdad." The exploration party arrived there early in February 1889, and remained only till the middle of April, when they were obliged to fly for their lives. It must soon have been very obvious to the leaders of the expedition that their enterprise could have no other ending. They were stranded in the midst of tribes of turbulent Bedouins, who tolerated their presence simply for the loot or plunder which they expected to receive or take. The expedition was not supplied with the means of appeasing the ever-recurring demands of the tribes for blackmail. The escort provided by the local representatives of the Turkish Government was worse than useless, and the American members of the expedition were too weak in numbers to be able to defy their enemies and maintain their position alone. The accidental shooting of a thief was the immediate cause of disaster. The tribe to which he belonged declared a war of vengeance. They might have been appeased, if the offender had been surrendered to them, but as this implied the execution of an innocent man, the proposal was rejected, and there was nothing for it but for the expedition to return. As they were about to start, the camp was set on fire, and, as Dr. Peters says, "The last that we saw of Nippur, the Essa'id were dancing a war dance on the ruins of our camp."

The second volume gives an account of the second expedition, and this may be described as distinctly a successful one. Dr. Peters returned from America having

successfully persuaded the local committee that the work of excavation should not be abandoned, and after settling his programme amicably at Constantinople with Hamdi Bey, the Director of the Imperial Ottoman Museum, he proceeded again to Nippur and resumed the work of excavation. In addition to the usual precautions for the safety of the members of the expedition, Dr. Peters encouraged a belief that he himself was a magician possessed of unknown and mysterious powers. Under the new auspices the work of excavation proceeded apace until May 1890. It is impossible for us to present to our readers even a summary of the work done, but we may note that whereas in the first year only four boxes of antiquities had been sent to Constantinople, in the second year thirty-six boxes were sent, "containing about eight to ten thousand inscribed tablets or fragments of tablets, and several hundred inscribed stones and stone fragments, among which were the oldest inscriptions theretofore discovered in Babylonia, or probably in the world." The great hope of the expedition was to discover the temple library, but in this they were disappointed. On the other hand, besides innumerable articles throwing much light on the civilisation of ancient times, they found many business and official records including "syllabaries, letters, chronological lists, historical fragments, astronomical and religious texts, building inscriptions, votive tablets, inventories, tax lists, plans of estates, etc."

Dr. Peters endeavours to construct a history of Nippur, and of the temple E-kur or Mountain House, and the Ziggurat or High Place, which was called Nugar-sag, Mountain of Heaven, or Sagash, High Towering. He is of opinion that Nippur on the north, and Ur and Eridu on the south, of the great Babylonian plain were already populous and powerful cities not later than 6000 or 7000 B.C. The earliest inscriptions, however, belong to about 4000 B.C., when Babylonia was known as Kengi or "land of the canals and reeds." They show that "Erech, Lagash or Sirpurla, Eridu, Ur, Isin, Larsam, and above all Nippur, were important cities at that early period, and that Nippur was the religious centre of the country." Kengi was conquered by Lugal-zaggisi of Kish, a strong city to the north, whose inscriptions indicate that before 4000 B.C. he ruled an empire "stretching from the Persian gulf to the Mediterranean, with Erech in southern Babylonia for its centre." Lugal-zaggisi had a successor with the unmanageable name of Lugal-kigub-nidudu, who transferred the seat of government to Ur. Later on Lagash or Sirpurla became the seat of government, and the Elamites from the north-east commenced their predatory raids on Babylonia. About 3800 B.C., Alusharshid, King of Kish, reconquered part of the plain as far as Lagash, and after him comes the well-known Sargon of Akkad, whose empire included Babylonia, Mesopotamia, Syria, Elam, Cyprus, Palestine, Northern Arabia, and the peninsula of Sinai. The earliest dated bricks found in the temple are those of Sargon, 3800 B.C., and his son Naramsin, 3750 B.C., after which there is a long hiatus of about a thousand years, the history of which is practically unknown, except that during that period the great temple seems to have fallen more or less into ruin. About 2800 B.C. Ur is found to be the principal city of Babylonia, and the king, Ur-gur, built the ziggurat or High Place of Bel, on the top of the ruins of Sargon. In the ziggurat there was an altar which "occupied in relation to the ziggurat substantially the same position which the altar in the temple of Yahweh at Jerusalem occupied in relation to the Holy Place of that temple." Ur-gur was succeeded by his son, Dungi, of whom many inscriptions have been found. After the time of Dungi, Isin seems to have been the leading state in southern Babylonia for a short time, after which Ur recovered the supremacy, and during this period its kings ruled over Syria and Phœnicia. After this an Elamite dynasty held sway with Larsa as their capital, and "plundered the temples of Babylonia ruthlessly." Dr. Peters supposes that it was during this

Elamite dynasty that Abraham emigrated to Canaan. The Elamites were vanquished after a prolonged contest by Hamunrabi, King of Babylon, who sacked the temple of Bel at Nippur, and made the temple of Bel Mardak, at Babylon, the principal seat of worship. The Babylonian power was greatly weakened by the attacks of the Elamites on the south and the Assyrians on the north, and fell before the Cossæans, who inhabited the mountains to the east. The Cossæan dynasty lasted for three hundred years, during which Nippur was reinstated as the principal seat of worship. The Cossæan empire was conquered by Nebuchadnezzar I. of the Pashe dynasty, who destroyed the temple of Bel at Nippur, and transferred the religious, as well as the political, supremacy to Babylon. The Babylonian empire in its turn was conquered by the Assyrians in the eighth century B.C., and some time in the first half of the seventh century Esarhaddon and Ashurbanipal restored Nippur to its original importance, and rebuilt the ziggurat with bricks, on each of which there is the following inscription :—"To Bel, lord of lands, his lord, Asharban-aplu, his favourite pastor, the powerful king, king of the four quarters of the earth, built E-kur, his beloved house, with bricks." Ashurbanipal died in 626 B.C., shortly before the collapse of his empire, and Babylon again became the seat of government for a time, during which Nippur was captured by King Nabopolasar, who sacked the city and destroyed the temple. In 538 B.C. the Babylonian empire fell before Cyrus the Persian, whose dynasty lasted for a couple of centuries. Dr. Peters conjectures that about 500 B.C. the temple at Nippur was reconstructed for the last time, but consecrated to the worship of some deity other than Bel. The Persian empire was overthrown by Alexander the Great, at whose death it passed to his general, Seleucus Nikator, who removed the capital to Seleucia, near Baghdad. The Seleucian dynasty lasted one and a half centuries, and fell before the Parthians, who held sway for four centuries, and succumbed to the second Persian empire, *i.e.* the Sassanian, which in its turn, after an existence of four centuries, fell before the Arabs in the battle of Kadasiah, 637 A.D. Since then Babylonia and Nippur have been in the hands of the followers of the Prophet, whose rule, except during the brief period of the Abbasside Caliphs, has been one of utter wretchedness and misery for the inhabitants. The great temple at Nippur, restored more or less about 500 B.C., fell gradually into ruins, so that its origin and purpose became unknown, and it degenerated into a site or a quarry for houses or a receptacle for graves. The history of course is very far from complete, but so far as it goes it is an important addition to the history of ancient times. When the tablets and inscriptions unearthed by Dr. Peters and Dr. Haynes have been deciphered and collated, we may confidently expect that our knowledge of ancient Nippur and Babylonia will be greatly increased.

The Founders of Geology. By Sir Archibald Geikie, F.R.S., etc. etc. London : Macmillan and Co., 1897. Pp. 297.

Probably no one could have written a book like this more successfully than the author of the admirable *Memoir of Murchison.* It comprises the course of lectures delivered by Sir Archibald Geikie in inaugurating the lectureship founded by Mrs. Williams in the Johns Hopkins University at Baltimore, United States of America. He traces the progress of geology from the Cosmogonists, on through the rise of volcanic geology, the doctrine of geological succession, the modern conception of the theory of the earth, and the rise of stratigraphical geology, linking each epoch of progress with the names of the great thinkers and investigators who are deservedly called the "Founders of Geology."

We naturally turn with interest to our own Scottish school of geology, which

Sir Archibald Geikie has so often described—Hutton, Playfair, Hall—and their descendants Murchison, Lyell, Logan, Nicol—and we find their unrivalled contributions to geology duly and lovingly chronicled by one who still continues the glorious line. Sir Archibald touches a new chord in alluding to Hutton being indebted for much of his geology to the admirable environment of his native city of Edinburgh :—"He could not take a walk in any direction without meeting with illustrations of some of the problems for the solution of which he was seeking. If he turned eastward, Arthur's Seat and Salisbury Crags rose in front of him with their memorials of ancient volcanic eruptions. If he strolled westward, the ravines of the Water of Leith presented him with proofs of the erosive power of running water, and with sections of the successive sea-bottoms of the Carboniferous period. Even within the walls of the city, the precipitous Castle rock bore witness to the energies with which in ancient times molten matter had been thrust into the crust of the earth."

Omissions in a work like this are probably inevitable. We should have liked due reference made to such distinguished names as those of John Fleming, who laid the foundations of our knowledge of the Old Red Sandstone formation ; James Croll, who explained the cosmical causes which led to the recurrence of glacial epochs ; William Pengelly, who proved by his speleological researches the dependence of archæology upon geology. Nor should we forget that, however active and brilliant Murchison was, he was scarcely entitled to so large a space when Hugh Miller's name is absolutely omitted ; for whilst the latter is probably the best-known geological writer of the century, the fondest theories of Murchison were shattered on the rocks of the north-west Highlands.

The Matabele Campaign 1896. Being a Narrative of the Campaign in suppressing the Native Rising in Matabeleland and Mashonaland. By Colonel R. S. S. Baden-Powell, 13th Hussars. With nearly 100 Illustrations. London : Methuen and Co., 1897. Pp. 500. *Price* 15*s*.

Colonel Baden-Powell, when abroad, keeps an illustrated diary for his mother ; it consists of sketches written and sketches drawn. The sketches are good, especially those drawn, and will serve to give the stay-at-home public a good idea of the adventures of the Empire-makers. They will also give useful information to the "new chum." The ground covered during the Matabele campaign was very extensive, and as our author has a good eye for detail, and is a good observer, much of interest can be gathered from his rough, crisp pages ; whilst at times, when the men are in a tight place, excitement adds zest to the narrative. Colonel Baden-Powell remarks in his preface that something can be learned from his book by those who care to learn, and this is true. The following quotation might with advantage be taken to heart :—"Of course our first business was to interview all the heads of affairs, and so to form an idea of the situation. Sir Richard Martin . . . is Deputy Commissioner, appointed since Jameson's raid to regulate the use and moves of the armed forces in the Chartered Company's territories, so as to prevent any further adventurous departures on their part. Lord Grey is Administrator of the Government of the whole country of Rhodesia, which includes Matabeleland and Mashonaland, etc.—a tract of country 750,000 square miles in extent, or equal to Spain, France, and Italy together. Mr. Cecil Rhodes, while bearing no official position, practically represents the management of the country, as well as of the Company, and his advice and experience are of the greatest value, since all the other 'heads' are new arrivals in the country. And it is in this number of heads that our danger would

apparently, and our difficulty will most certainly be. Virtually, of course, the General is *the* head while active operations are in progress, but he has to cut his cloth according to the style approved by the Deputy Commissioner, according to the expense sanctioned by the Administrator, and according to the general design required by the High Commissioner, while not totally disregarding the local experience of Mr. Rhodes and others. Altogether, the principle of strategy, which directs that 'the General in command should merely have his objective pointed out to him and a free hand given him,' seems to be pretty well trenched upon by the present arrangement, though, under the circumstances, it could not well be helped. This, however, has always been the case in the history of South African warfare—frequently with fatal results—so it is nothing new; the only thing is to make the best of it, and pull together as much as possible." With such a state of affairs it is small wonder that our "little wars" are so badly managed. The causes of the Matabele revolt are clearly stated, and it is evident how it might have been avoided.

The pluck and dash of the volunteer troopers were above all praise, and hampered as they were with lack of food and transport, and sickened with the rotting carcases of cattle killed by the rinderpest, the only wonder is that they brought the campaign to a successful conclusion. At the time a good deal was written on the brutal way in which the natives were hunted down. Of this our author writes:—"I did not at the time (the first fight in which he took part) fully realise the extraordinary bloodthirsty rage of some of our men when they got hand to hand with the Kafirs, but I not only understood it, but felt it to the full myself later on, when I too had seen those English girls lying horribly mutilated, and the little white children with the life smashed and broken out of them by laughing black fiends who knew no mercy." It should also not be forgotten that the natives expected no quarter, as they had gone beyond their own etiquette of war by killing the white women and children.

Many valuable hints are to be found in these pages on scouting and native warfare. The book is well worth reading, and Colonel Baden-Powell's views as to the training of scouts (p. 120) should certainly be adopted.

The photographs and black-and-white sketches are very good.

Pictures of Southern China. By the Rev. J. Macgowan, London. London: The Religious Tract Society, 1897. Pp. 320. *Price* 10*s.* 6*d.*

We trust we are not doing an injustice to the Rev. J. Macgowan, when we suspect that the *raison d'être* of this book was, that he had a remarkably good series of photographs of scenes in some of the principal towns of the south coast of China, which he thought—and rightly thought—would be interesting to, and appreciated by, the public. But in addition to the attraction of excellent illustrations, the book may be recommended as setting before the reader many equally excellent descriptions of some important Chinese towns, the adjoining country, and the inhabitants. The writer is a patient and acute observer, with the eye of an artist, and a considerable power of style. He is impartial also, seeing full well the good points of the Chinese as well as the bad, and concealing neither the one nor the other. Perhaps the most effective passages in his book are the descriptions of typhoons and storms, of which he seems to have had an unusual experience. There is also the inevitable description of an opium den, without which it seems impossible to write a book on China; but, to do justice to Mr. Macgowan, we must add that in his work the subject of opium is treated with a moderation and conciseness which we rarely meet with in the publications of the clergy. The writer does not pose as an

authority on China in general. His book was written "after having simply walked through the streets of a few of its towns, and conversed with a number of its people." This being kept in view, the "Pictures of Southern China," and especially the illustrations, will not fail to interest and amuse the general reader.

If the book ever reaches a second edition, Mr. Macgowan would do well to carefully revise the letterpress, and correct several errors of grammar which now disfigure it; they are merely the result of carelessness or haste.

Impressions d'Égypte. Par Louis Malosse. Paris: Armand Colin et Cie., 1896. Pp. 357. *Price* 3 *fr.* 50 *c.*

M. Malosse seems to have set himself the task, in this carefully written book, of showing that Egypt is still subject to French ascendency, and that the administration of Egypt under British auspices has proved a failure. He even maintains that, were the British to leave Egypt to-morrow, not a trace of their fifteen years' rule would remain. His book is apparently intended as an antidote to Sir A. Milner's *England in Egypt*; but, like many special pleaders, he rather overstates his case. The influence of Great Britain has ameliorated the lot of the fellah in a manner hitherto unknown. Witness the abolition of the corvée, the courbach, and the slave-trade. The British found the Barrage in ruins, and under the superintendence of an officer of their Royal Engineers (Sir Colin Scott Moncrieff) it was repaired and made once more to perform its essential service to agriculture. They instituted a system of water supply which renders the former robbery of the fellaheen impossible. The British found Egypt verging on bankruptcy; they have given it a financial prosperity it never before possessed. Nor will all traces of them be lost when "their last battalion departs," as M. Malosse affirms. The railway from Assiout southwards, and more recently that from Wady Halfa to Abu Hamed and Berber, will remain as evidences of their enterprise, and be considered of greater value to Egypt than the French theatre at Cairo, of which M. Malosse is so proud.

Whilst making these remarks, we recognise the value of this work, both as a statement of the French case, and as a thoughtful description of Egypt as it is, from a French point of view.

Les Nouvelles Sociétés Anglo-Saxonnes. Australie, Nouvelle Zélande, Afrique australe. Par Pierre Leroy-Beaulieu. Paris: Armand Colin et Cie., 1897. Pp. 493. *Price* 4 *fr.*

Not perfectly satisfied with their own methods, the French are studying Anglo-Saxon institutions, and whilst MM. Boutmy and Leclerc describe English politics, education, and society, M. Beaulieu tells his countrymen how the British colonies are constituted. The greater part of this volume has already appeared in high-class French reviews, and it is entirely the result of a personal visit made by the author in 1895-96. He considers the colonies of Australia and New Zealand a peculiarly interesting study, as they represent "purely democratic societies, sprung from the humblest orders of the British people—societies where neither the influence of tradition nor the vestiges of ancient customs or institutions have, by mingling the past with the present, had any effect upon the free play of newly acquired forces." In this respect he regards them as more interesting than the longer settled United States.

Whilst Australia and New Zealand occupy the first part of the book, South Africa is discussed in the second, and Imperial Federation in the third. Regarding the last subject the author observes that "its partisans in the colonies desire

Imperial Federation in the hope that the Mother Country will more than ever be obliged to accept their terms, and to adjust its policy to their wishes. For Great Britain it would mean an increase of difficulties, augmenting her 'splendid isolation. Besides, she could rely on no effective help from the colonies, which would not consent to remit even a small portion of their revenues to London to provide for Imperial defence. For the British Empire as a whole, Imperial Federation would perhaps be the preface to dissolution."

En Congolie. Par Edmond Picard. Deuxième édition. Bruxelles: Paul Lacomblez et Vve Ferd. Larcier, 1896. Pp. 232. *Price F.* 3.50.

We have received the second edition of Monsieur Edmond Picard's *En Congolie*, a work which will always deserve perusal as a specimen of word-painting and highly coloured description. The senator (for Monsieur Picard never forgets he is a senator) spent the months of August, September, and October of last year in travelling from Antwerp to Boma on the west coast of Africa, whence he made a short excursion to Matadi in the interior, and inspected the progress of the construction of the railway to Tumba. He seems to have had a most uncomfortable voyage in a wofully overcrowded ship. His descriptions of the scenery of Congolia, although vivid and skilful, are tinged with a feeling of sadness or even despair as he moralises on the deadly climate and its terrible effects on the moral and physical condition of the adventurous white men who have the courage or the folly to face it. Certainly his description of the moral degradation and physical debility of white men there after a year or two in the country is enough to deter any of his compatriots and others, however adventurous, from seeking in Congolia a field for their energy and ability. Even the natives are a weakly, degraded, fever-stricken race, and all public works—*e.g.*, the construction of the railway—have to be carried out by imported labour. Ivory and caoutchouc are the principal articles of export, and we suspect that the main object of the senator's voyage was to obtain information on which he can denounce the King of the Belgians as "the biggest caoutchouc and ivory merchant in the world," and fortify his contention that the king should give up his private interest in the trade to the State—a measure calculated to produce most satisfactory results to the Belgian treasury.

An accurate but painful description of Congo is given in a local song, from which we quote the last stanzas:—

"Dans le Congo, la Dyssent'rie
Fait des razzias;
La fièv' bilieus', l'hématurie
Emboit' le pas.
Puis c'sont les sagaies et les lances
Des Indigos
Qui flanqu' le restant sur la panse
Dans le Congo!

"On est méchant, farouche et lâche
Quand on r'vient de là.
Mais l'plus souvent d'chez ces sauvages
On n'revient pas.
On n'a pas même un coin d'cimetière
Pour ses pauv' z'os
Un' croix d'bois qui tombe en poussière,
Voilà l'Congo!"

Nel Paese delle Amazzoni. Del Prof. Dott. Vincenzo Grossi, libero Docente di Etnologia Americana nella R. Università di Genova. Roma: Tip. dell' Unione Co-operativa Editrice, 1897. Pp. 130. *Prezzo L.* 2.

The Amazons is a large region to describe in a small book of 130 pages. The chapters, therefore, on the physical geography, climate, etc., of the basin are rather sketchy. The facts are correct, many of them, indeed, being derived from Reclus, Wallace, Agassiz, and other well-known authorities. It should, however, be stated that the title of the first and most important part of the volume is *Gli Stati di Pará e Amazonas dal punto di vista della Navigazione e del Commercio Italiani.* Consequently the chapters which deal with the steamship lines and the products of the country are much fuller, and many of the statistics are interesting. Thus the export of india-rubber shows a steady increase; cocoa is evidently an uncertain crop, for the quantity exported varies considerably from year to year; vanilla offers great promise of gain to enterprising planters.

The Italians import many of the products of the Amazons from other European countries, and Professor Grossi seeks to stimulate his countrymen to greater commercial energy, and invites them to support an Italian line of steamers lately placed on the Amazons route.

The book is neatly got up and adorned with tasteful headpieces, which, however, seem to have no connection with the Amazons.

Reisen in Süd-Arabien, Mahra-Land und Hadramūt. Von Leo Hirsch. Leiden: E. J. Brill, 1897. Pp. xii + 232.

The publication of Herr Hirsch's experiences in Hadramūt has been long delayed, his journey having taken place early in 1893. It is nevertheless welcome as the only detailed description of the country from personal observation, the late Mr. Bent, who followed nearly the same route to Hadramūt in the following year, not having written anything on Southern Arabia longer than magazine articles. Like Mr. Bent, Herr Hirsch had considerable difficulty in getting into the interior, and had abundant opportunity of making himself acquainted with the coast towns—Sheḥr, Sēḥut, Gishin, and Makalla. In the Hadramūt valley he succeeded in getting as far down as Terim, where the opposition of the Arabs became so determined that he was obliged to return immediately to Shibām, Mr. Bent's farthest point. On his return journey to Makalla he followed another route crossing the Figra mountains.

Having considerable knowledge of Arabic, Herr Hirsch was able to obtain much valuable information from the sheiks of the towns and villages he passed through, and he has taken great pains to learn the correct forms of the place-names, and their etymological meanings.

From Jungle to Java; the Trivial Impressions of a Short Excursion to Netherlands' India. By Arthur Keyser. Westminster: The Roxburghe Press, Ltd., n.d. Pp. 129. *Price* 2*s.* 6*d.*

This little book "professes to do no more than describe a pleasant tour" from Pura Pura, an obscure station in one of the small States of the Malay Peninsula, to Tambak, an equally obscure village in Java; and it carefully and intentionally avoids discussing any of the social or political problems which present themselves before every traveller in the great Dutch colony. Instead of this, we have descriptions of hotel life and hotel cooking, and the difficulties of travelling when the traveller does not know Dutch, and where cheques are not accepted. The

writer has a good word to say for the scenery and for the kindness and hospitality he received from the Dutch officials, and he remarks on the servility they demand and receive from the natives.

Chauncy Maples, D.D., F.R.G.S. A Sketch of his Life, with Selections from his Letters. By his Sister. London: Longmans and Co., 1897. Pp. 403. *Price 7s. 6d.*

Chauncy Maples was one of the most lovable men who, like David Livingstone, have lived and died for the people of Central Africa. With natives and Europeans alike he was most popular. For nineteen years he was a pioneer of the Universities Mission in Central Africa. Layman, priest, archdeacon and, finally, Bishop of Likoma, the island in the centre of Lake Nyasa, he was ever at work, with an energy, a simplicity, and an efficiency which bore fruit even in his own days. Like Bishop Hannington, he was full of humour and common sense; like him, too, he need not have died as he did and when he did. On his fifth visit to England, in 1895, he was made Bishop in St. Paul's Cathedral. Six weeks after he landed in Africa, on 2nd September of that year, he and another white man, Joseph Williams, were drowned in a Nyasa storm, into which he should never have ventured in a small open boat. The bulk of the book consists of his letters—vivid pictures of missionary life and work of the most self-denying kind. Anglican though he was, he was most friendly with all the Scottish missionaries and captains of labour. Names like the late Dr. Steele and Mr. Fotheringham, like Dr. Laws and Mr. Hetherwick, appear in these pages, with honour and gratitude to Dr. Laws. Maples wrote a paper on Masasi and Rovuma for the Royal Geographical Society, translated not a little into the Yao and Swahili languages, wrote a grammar of the Makua language, and composed hymns and tunes for the natives. "I am made for Africa, and African soil must one day provide a resting-place for my worn-out bones"—such were his words not long before sudden death removed the devoted missionary. His body was found, and buried at Kota Kota.

Album Géographique. Par Marcel Dubois et Camille Guy. Tome premier: *Aspects généraux de la Nature.* 500 gravures. Pp. xvi+247. Tome deuxième: *Les régions tropicales.* 450 gravures. Pp. xix+244. Paris: Armand Colin et Cie., 1896 and 1897.

We have had occasion in these pages to animadvert on the waste of good material for geographical purposes through the uncritical and unintelligent arrangement of the numerous picture-books of places which have been recently issued by several English publishers. The receipt of this French publication prompts the familiar quotation, "They order this matter better in France." Not that the pictures are better—indeed, some of them are poorer—than those in the English productions, but the arrangement of the illustrations and the contents of the brief letterpress elucidating them possess a symmetry and a lucidity which make the even somewhat less satisfactory pictures form a much more valuable work than the pot-pourri of the English publishers. Although some of the figures are familiar enough, yet the bringing of them all together in proper order by competent editors is a great service. They form ideal geography books for young people, as well as useful illustrations for their teachers; and until English publishers improve on this work, we should advise no school to try to do without it.

Murby's Geography and Atlas, consisting of the *Elementary Geography for Schools*, by A. H. Dick, D.Sc., M.A., L.L.B., F.R.G.S., corrected to the present date: together with twenty-four beautifully engraved and coloured Maps. London: Thomas Murby, n.d. Pp. 219. *Price* 2*s*.

This book professes to be revised and "corrected to the present date" (1897, as we learn from the preface). In the face of this profession, it stands self-condemned by such statements as:—"A ship canal between Manchester and the estuary of the Mersey is in course of construction" (p. 31); "Madras is a harbourless seaport" (p. 79); France has a short slope "eastwards to the Rhine, where that river forms the boundary" (p. 97); "In the basin of the Nile are Lakes Tanganyika, Victoria Nyanza, and Albert Nyanza" (p. 155); "The Mediterranean is deeper and salter than the Atlantic" (p. 194). No mention is made of Esquimalt, Nanaimo, the nitrates of Chile, or the Kaiser Wilhelm Canal. In the maps of South Africa the new railway stops at Kimberley, and none is marked in the South African Republic.

We cannot but protest against the issue of such books.

Hazell's Annual for 1898. A Cyclopædic Record of Men and Topics of the Day. Edited by W. Palmer, B.A. (Lond.). London: Hazell, Watson, and Viney, 1898. Pp. 690. *Price* 3*s*. 6*d*.

The general arrangement of the contents of this annual are unaltered. There are, as usual, new articles on the most prominent topics of the day and a number of new biographies. Among them are important articles on British foreign and colonial trade, and a short, but fairly complete, summary of recent explorations.

Die Insel Rügen, mit Berücksichtigung der benachbarten Städte des Festlandes: Stralsund und Greifswald. Führer für Badegäste und Touristen von Edwin Müller. Berlin: Barthol und Co., 1897. Pp. 174. *Price M.* 1½.

Though having no pretensions to grandeur, the scenery of Rügen, with its smiling valleys and meadow-lands and rocky cliffs, possesses some attraction for the tourist. The geologist and archæologist also find much to interest them in the island. Visitors will do well to procure this handy guide, which supplies full information on all parts of the island and the means of travel. That the work has now reached its sixteenth edition is a proof that it has been found useful. The maps are numerous.

Rambles in Polynesia. By "Sundowner." London: European Mail, Limited. Pp. ix + 207. *Price* 4*s*.

In this volume the reader will find a number of pleasant and readable sketches of Polynesia and its inhabitants. The writer evidently has a warm sympathy for the semi-savage races in these islands, and, while not concealing the darker shades of their character, he endeavours to paint them in attractive and rosy colours. He has an artist's eye for the picturesque and a facile pen, when describing what seems to be an everyday occurrence in Polynesia, viz., personal encounters with sharks. The islands, according to "Sundowner," are an excellent place wherein to spend a holiday, but are not of much use for serious business.

NEW MAPS.

EUROPE.

ENGLAND. Bartholomew's Reduced Ordnance Survey. Bedford, Hertford, etc. Huntingdon, Cambridge, etc. *Price 2s. each.*
The Edinburgh Geographical Institute.

ASIA.

GROOT ATJEH, Kaart van het Gebied bezet in ——, met de Nederzettingen Lepoeng en Lehoeng, op de Schaal 1 : 40,000, en eene Overzichtskaart volgens de nieuwste gegevens samengesteld door L. W. K. J. Thomson, 1e Luitenant der Infanterie, Ridder der Mil. Willemsorde 4e kl.
J. Smulders and Co., te's Gravenhage, 1897.

A neatly executed and attractive-looking map, showing surface features, roads, dykes, military posts, etc. The small general map shows all the political divisions, and the orography and hydrography of the northern extremity of Sumatra.

AFRICA.

SOUTH AFRICA, The Railway Map of ——, 1898. *Price* 1*s.*
Offices of "South Africa," London.

The map shows in bold lines all the existing railways, those under construction, and those that are only proposed.

AMERICA.

ALASKA. Route Map—Juneau to Porcupine River. Scale 1 : 1,200,000. U.S.C.G.S. *Presented by Mr. Coutts Trotter.*

PERU, Mapa del. Por A. Raimondi. Sheets 21 and 25.
Presented by the Geogr. Soc. of Lima.

PARAGUAY, Mapa de la República del ——. Con los ultimos Datos Geográficos por Cleto Romero. Escala 1 mm. = 1000 metros.
Presented by Heer Oostendorp, Consul-General of Paraguay in Belgium.

A map of this country is very welcome, as so little detailed survey has been executed there. The present map contains much information that will be useful for reference, and also shows how much has still to be sought for. It is accompanied by a geographical sketch, with statistical and other details.

CHARTS.

SCOTLAND.

No. 512—Approaches to Stornoway.
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Robert E. Peary U.S.N.

From a Photograph by John Thomson, Grosvenor Street, London.

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SOME ACCOUNT OF SOMALILAND:

WITH NOTES ON JOURNEYS THROUGH THE GADABÜRSI AND WESTERN OGADEN COUNTRIES, 1896-1897.

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(*Read before the Society in Edinburgh on Dec. 16th*, 1897.)

I. Historical.

Although Somaliland is not far off our highway to India and the East, and its northern coast has been within twenty-four hours' sail of the nearest British station ever since H.M.S. *Volage* captured Aden in 1836, it is only in comparatively recent years that we have been able to obtain any reliable geographical and ethnological information with regard to what may almost even yet be described as the Unknown Horn of Africa. Unlike other parts of northern and north-eastern Africa, it seems to have possessed so inhospitable a character, that the explorers of ancient, as well as of modern times, have been alike warned off. It would have been curious, however, if that most remarkable of travellers, Burton, having once cast his eye on this land of hidden mystery and interest, had not made an attempt to lift the veil; and still more strange if he had not, at least partially, succeeded where he attempted. He obtained the countenance of the Bombay Government in 1854, who permitted Lieut. Stroyan, I.N., and Lieut. Speke to join the expedition.

Burton's original idea was to march from Berbera to Harrar, and thence south-east to Zanzibar. At Aden the authorities considered the task one of the most extreme danger. So it was decided, in the first place, to court the goodwill of the Somalis by sending Stroyan and Lieut. Herne to the annual native fair at Berbera, and Lieut. Speke was sent to Bunder Guray with a view to finding out how the land lay beyond the

maritime chain, and to trace, if possible, the course of the Nogal Tug. Speke failed to get beyond the mountain zone. In the meanwhile, Burton, on the 29th of October 1854, started as an Arab merchant, and, on the 9th of February 1855, returned to Aden, having accomplished the journey from Zeila to Harrar, and from Harrar to Berbera, and was ready for the larger undertaking. On April 7th, 1855, the second expedition was ready to start, when all their plans were frustrated by an attack of the Somalis on them at Berbera, in which Stroyan was killed. Speke and Burton were wounded, but escaped in a marvellous manner to the British gunboat. Burton's *First Footsteps in Africa* remained the first footsteps, as far as Somaliland was concerned, for another generation. But his book remains the most fascinating and reliable record that we have of such parts of Somaliland as he visited. During my first journey I went, in the company of my wife, Mr. E. N. Buxton, and Mr. A. E. Leatham, over a great portion of the country traversed by Burton; and we can testify that Burton's relation of the conditions of life and habits of the people, as well as his geographical observations, is so excellent and so little affected by time and political changes, that those who wish to have information with regard to the country between Harrar and Berbera, and its inhabitants, cannot do better to-day than read his account.

We have to come to 1891 before anything like Burton's original idea of crossing the Horn was accomplished. In this year Robecchi made his way from Magadosho to Barri, and, after two attempts to reach Harrar, passed by Milmil across the Howd to Berbera. The first laurels, however, were won by the brothers James, Mr. Lort-Phillips, and Mr. Percy Aylmer, who in 1885 reached Barri, and for the first time saw the Webbe Shebeyli—an expedition that gave the most fruitful results.

1881. Révoil visited the Mijertins.
1885. The Jameses, Aylmer, and Mr. Lort-Phillips reached Barri.
1891. Robecchi's expedition.
1891. Baudi di Vesme went by Milmil to the Upper Webbe Shebeyli.
1893. Captain Swayne reached the Webbe Shebeyli at Imé.

During the last two or three years Lake Rudolph has been reached by several English and Americans, from the north; and by others, including Count Teleki and Chanler, from the east.

The Somalis of the east coast, and certain tribes in the upper regions of the Jub, or Webbe Genana, are more difficult to deal with than those of North Somaliland; and were the whole list of ill-fated expeditions that have tried to penetrate from the eastern seaboard to be mentioned, the tale would be an appalling one.

During the last year three Italian expeditions have been destroyed near the coast or in the interior; whilst in recent years several Italian explorers, even in those regions which Englishmen and others have crossed without much difficulty, have lost their lives. But the ill-success of the Italians, though due in the main to the dangerous nature of the countries they have attempted to penetrate, and of their inhabitants, is partly the result, I think, of the want of those qualities which are

possessed by most of our fellow-countrymen—qualities difficult to describe, but which include patience, tact in dealing with, consideration for, and generosity to, natives, combined with what is not a British monopoly, courage. Perhaps, owing to poverty, the Italians have at times been driven to acts of plunder, or at least to a want of generosity to the natives; but no one can charge them with want of pluck and perseverance, and we must recognise the great discoveries they have made. To them we owe much of our present geographical knowledge of the interior. Signor Bòttego's last work, which cost him his life a few months ago, consisted in solving the problems relating to the southern Ethiopian Highlands, and the country lying north of Lake Rudolph. He has fixed the course of the Omo; he has explored the western shore of Lake Rudolph; and has defined the hydrographic features of the Sobat system. He discovered the lake Abba Pagade, about ninety-five miles in length, which he has named Lake Margharita. The Omo flows through the walls of mountains that Dr. Donaldson Smith found himself unable to cross. Lord Delamere, whom we joined for a while in the interior, is now in these parts, and no doubt will bring back some further important information with regard to what lies beyond Lake Rudolph, or Samburu, to the west. Still more recently, within the last few weeks, Mr. H. S. H. Cavendish has returned home after an extraordinarily rapid journey from Berbera, *viâ* Logh, the Genana, and Lake Stephanie, to the northern shore of Lake Samburu: thence he marched down the western side of the lake, and has added to our knowledge of these regions by successfully continuing his march, beyond the Tirgoll river reached by Signor Bòttego from the north and by Count Teleki from the south, to the southern extremity of the lake. Thence Mr. Cavendish continued his journey by way of Lake Baringo to Mombasa, discovering a new lake by the way. During his journey he made some interesting discoveries, among which may be named the recent extinction of the Teleki volcano, a remarkable salt crater 1300 feet deep, 100 miles east of Lake Stephanie, and a coal bed west of Lake Samburu (Rudolph).

II. Political and Descriptive.

As you are aware, the greater part of the Horn of Africa was, until this year, an Italian sphere of influence and nominal protectorate; though a small strip of the northern coast, from Zeila to Bou Ziada, with most of the hinterland down to lat. 8°, formed, from 1889 till this year, the British Somali Protectorate. With the acquiescence of the Italians, or at least without their objection, the British influence penetrated far south of lat. 8°, and the British authority was often welcomed in the settlement of native difficulties, with at least the tacit consent of the Italians. I have no wish to bring into my paper any debatable question of politics, and will only remark that I personally view with great regret the fact that we are permitting our prestige and influence to suffer severely in abandoning the natives to the tender mercies of the Abyssinians. The natives have long looked upon us as their best friends and protectors:

we have prevented them from acquiring arms and ammunition, and, having deprived them of all means of self-defence, have abandoned them to their hereditary enemies, thereby recognising the ridiculous claims of Menelik to an immense region that never was part of the empire of Ethiopia. All we have gained in Somaliland has been without bloodshed and lavish expenditure, and it can only be from ignorance of the situation that Her Majesty's advisers think it worth while to purchase the goodwill of Abyssinia in the Nile valley by permitting the armies of Menelik to raid, ravage, and plunder our friendly neighbours, who have till now delighted to call themselves British, and whom we have rendered impotent to save themselves. If, as is rumoured, we are abandoning a large area of our existing Protectorate, the result will be most disastrous to British influence in these countries. Though we cannot say till we know the exact nature of the agreements concluded this year between Her Majesty and Menelik, there is enough to justify the apprehension that we have agreed to hand over a large portion of our Protectorate to Abyssinia, and that there is no effort to be made to save the Zeila trade from the ruin which must overtake it on the completion of the French railway from Harrar to Djiboutil. To appreciate the deplorable effects of such a policy it must be remembered that, owing to our attitude during the hostilities between Abyssinia and Italy, we are associated with the Italians in the native mind, and have already shared with them the loss of prestige consequent on their defeat at Adowa and its results.

The British Somali Coast Protectorate is administered from Aden, under the Government of Bombay, by Assistant-Residents at Zeila, Bulhar, and Berbera: these three officers are the only British resident in Somaliland. A small force of Bombay infantry is stationed at Berbera and Zeila, and there is also a native police camel corps. Three qualities of cloth *tobes* take the place of money in the interior, "Khailie," "Bafto," and "Merican": enormous quantities of this material go into the interior, and none of it is of British manufacture. On the coast, and for some distance beyond, the rupee is fast displacing the trade dollar (the Maria Theresa), though the latter is retained largely as a standard of value in native trade, and at Berbera is equivalent to Rs.2.2. Hindustani is the language of the Courts, and of trade on the coast.

Berbera is the seat of Government, being the most accessible, and the only good, port on the coast. Berbera was taken from the Egyptian Government in 1884, six months before the fall of Khartum: in 1889, Dec. 13th, British jurisdiction was declared over the Somali coast.

Before the occupation of Berbera by the Egyptians there was no permanent town, but an annual fair was held. Lieut. Cruttenden, of the I.N., remarks that in 1847 he saw "three ostriches walking quietly on the beach a week after the fair; and lions are commonly seen at the town well during the hot weather." Captain Swayne told me that, about five or six years ago, he had seen elephants near Zeila, on the shore. Burton, in his day, pronounced Berbera to be the key to the Red Sea; while the Somalis have a proverb to the effect that, "He who commands at Berbera holds the beard of Harrar in his hands." I will

not take up your time with any description of the trade of the country, but will content myself with the remark that the trade, even under the present inactivity, and almost discouragement it receives from the home authorities, is a paying one.

The colour of the Somalis varies a great deal. Tribes such as the Habr Toljala and Dolbahanta, in the east, are very dark. The Ogaden are lighter, and, in the far west, are remarkably fairer. A Habr Toljala may be all but black: a Mellingour Ogaden a pale, light buff. The Somalis are a purely nomadic people, each tribe moving about within definite boundaries, as pasture, water, or rain may lead them. There are no settled towns, or even villages, unless a few mud huts, a *kouba*, and a school at Hargaisa, and such places as Aubahadleh, constitute a permanent village: such permanence as there is about them is due to their being Mullah settlements, where a few children are taught the Korân, in the precincts of some saint's tomb, or by an individual or *hadji*, who is regarded as a holy man. There is no resident Kadi in the interior; any questions beyond the authority of the greybeards have to be referred to Berbera, Aden, or Arabia. Some Somalis are traders; others, on the coast, are sailors; and hundreds leave their country to seek wealth as *sidi* boys, or at any job, from coaling, driving a garry, to valeting at Aden—often to revert to their pastoral and looting life with their own tribe.

The political institutions of the Somalis are few and simple. The Korân is their law, civil and commercial, and regulates their social relations. Each tribe is independent of the other; a few of the larger tribes have Sultâns, the smaller tribes or subdivisions (*Rer*) have each their Agal or headman. The affairs of the tribe and the orbit of its circulation are arranged, by general debate and agreement, by all the men of the tribe.

Their social life and economy is equally simple. During the intervals of peace the pasturing of the *gale* (female camels), camels, and flocks is their sole occupation. Save the duty of defending these from looting, the chief work falls on the women and children; whilst the men sit under the trees with only one subject for thought, conversation, and song—that of looting, and their own exploits retrospective and prospective.

The men often seek matrimonial alliances with women of neighbouring tribes, with the object of securing protection from their neighbours. As often as not the lady is looted; but, as a rule, accepts her fate very philosophically.

The *karia* or village of a Somali *jilib* is as easily moved as a camp of tents. Their huts, *gurgi*, are simply bent boughs covered with skins and mats (*herios*). The mats are made of grass and bark, and form the covering or saddle of the baggage camels when loaded. All that pertains to the making, removal, or putting up of the *gurgi* is the care of the women; you may often see them standing under the trees, with a long strip of bark going in at one corner of the mouth to be chewed, and coming out at the other in fibre ready for plaiting. Their ropes are made from bark or aloe pounded into fibre. When a site for

the *karia* is selected, the women place the huts in a semicircle, whilst the men cut the thorns for the *zariba*, and handle them cleverly with a long stick called a *hangol*, which has a hook at one end and a fork at the other. The inner circle of the *zariba* is made into pens with thorn fences for the live stock.

The food of the Somalis is meat alone—almost always mutton or goat; on great occasions they indulge in camel. Their drink is milk, usually camels' milk, occasionally cows', though they never eat beef. The Midgans, an out-caste tribe, who are their slaves, shoot with the bow and poisoned arrow; they camp and feed apart from their masters; they often, alone of all Somali natives, have dogs; they eat all kinds of four-footed game, and I have known them devour a lion I had killed. The poison on their arrows is made from the root of the Wabé tree.

The Somali spear-heads are made by the Tomals, another out-caste or helot tribe. In most tribes (not Esa or Gadabürsi), each man carries two spears (pl. *uarmo*), a larger one (*warran waine*) for stabbing, and a smaller for throwing (*haughto*).

The prosperity and importance of a tribe is, in the main, measured by the number of its ponies; on these depend success in looting forays, escape from pursuit, and the possibility of recovering their own camels when looted.

The Somali is a born fighter and marcher. His eyesight, vigilance, familiarity with the country, and walking powers, fit him for an ideal camp-follower. The adaptability of this people is marvellous.

The Somali is vain of his personal appearance, devoting much time to cleaning, with the *athei* stick, his beautiful teeth, claying, curling, and frizzing his hair; and he invariably carries himself with a grand air. The old men shave their heads; the middle-aged wear their hair short and curly, shaving their heads from time to time; the young men wear their hair in frizzed-out mops parted in the middle, and manage to change it into a russet colour by keeping it in clay.

Somali names are native or Arabic, and most men have a distinct nickname: Benderig (Big Stomach), Dibi (the Ox), Waraba (the Hyæna).

The Somali women have been described as of the Venus Kallipyga order of beauty, and are by European standards remarkably deficient in good looks.

The matron wears her hair in an indigo or black net of cotton, which is most unbecoming and distorts the already unshapely head. High cheek bones, large flat heads, heavy features, round faces, fine large eyes, and, of course, beautiful teeth, characterise most Somali women. Such beauty or pleasing form as they ever possess is soon worn off by hard marching, toil, child-bearing, and child-carrying; and the plump, round-faced, smiling girl soon withers into a skinny, worn, and wrinkled hag, though maintaining an extraordinary degree of vitality and strength in her skinny, sinewy frame. The voice of the women is almost always pleasing—it is soft, musical, and plaintive. As amongst all followers of Islam, the sexes are more separated in sentiment, but the bond of friendship between man and man is stronger, than with us. Kissing is unknown amongst the Somalis.

The girls wear their hair in mops of string, the hair being tightly plaited into hundreds of little tails, and, of course, plentifully smeared with *ghee*. It takes about a fortnight to dress the hair, but once done it is done for good.

The strings of blue beads, and great masses of amber, or occasionally of silver, make handsome necklaces, which set off the rich brown colour of the necks. Bracelets are also worn, and, like Arab children, the little Somalis often wear armlets and anklets of metal or silver.

The Midgans, helot hunters and servants; the Tomals, helot blacksmiths and shoemakers; and the Yibbers, are out-caste tribes representing the aboriginal race of the country.

III. Origin of Race and Language.

The origin of the language, like the origin of the race, is wrapped in mystery. There are those who consider the Somalis to be of North African Berber origin, and point to the name of Berbera as an indication of this. The name of Berbera, however, if indeed it is derived from any settlement of strangers, is more likely to be due to an occupation from Berber in the north-eastern Sudan. Perhaps the old theory of Sir R. Burton is the most correct one—that they are of Negro-Hamitic descent, and "nothing but a slice of the great Galla nation Islamised and Semiticised by repeated immigrations from Arabia." Such a theory is in the main in harmony with the Somali traditions of their Arabian descent, and geographical and historical conditions do not conflict with it; moreover, the physical type of the people agrees with it. The origin of the Gallas is another question altogether. Whether they are a part of the same race which pushed into South Africa from the north and are now represented by the Kaffirs, or whether they are a half-caste Abyssinian race, need not here be discussed.

Somal, or Somali, is a name that has only been in use to describe the dominant race in the Horn of Africa since the beginning of this century. Sir R. Burton (1856) says that the Somalis call their country Barr-al-Ajam. The old maps name the country Asha and Hawiya. The derivation of the word Somal has puzzled people. Major Abud, whose authority must carry great weight, leans to that which has been suggested by the language itself. He says, "The Somal are a hospitable race, and, as milk is their staple food supply, the first words a stranger would hear in visiting their kraals would be 'So-mal,' *i.e.* 'go and bring milk.' I have heard it suggested that the other word for milk, 'liss,' may account for the termination 'lis' in 'Somalis.'" As a matter of fact, "So-liss" is not used in a command to go and bring milk, or to go and milk a camel for a visitor, but only in ordinary conversation, and "Somal" is the usual command in bidding any one to go and bring milk for the refreshment of a stranger. In any case, there is nothing indicative of the origin of their language or race in the name Somali or Somal. Sir R. Burton has a note on the name Somal, where he alludes to a traveller who asserted that Somali was derived from the Abyssinian "Soumahe" (heathen).

Another suggested origin of the Somali race is India, and it is said that several ruins of temples, such as that found at Sheikh, in the Golis range, are similar to the temples of the Deccan. There are numerous Hindustani words in use among the Somalis, but they might all probably be traced to their dealings with East Indian merchants on the coast, the present adoption of Hindustani in the British Courts of justice, and the employment of Indian servants, clerks, and troops by the British representatives in the country.

In Major Abud's and Captain Cox's work on the genealogies of the Somal, the following passage occurs in the preface, and few have devoted more time and ability to collecting the descents of tribes which till now have been handed down from generation to generation by memory :—

"It will be noticed that the Darod and Ishak sections claim descent from certain noble Arabs—in the case of Ishak from the cousin of the prophet Mohamet himself; but such claim has only been recognised in order to obtain a starting-point, and it is not intended that the genealogical question should be taken as proved by the assumption, though the Somal declare that proof is in the hands of the priests at Wahat, a village near Al Hautah (Lahej), in Arabia, and that this proof was treacherously sold by Ibrahim, nicknamed Sambur, 'Big Nose,' son of Sheikh Ishak bin Ahmud. Captain Hunter, C.B., C.S.I., states in the preface to his Somali Grammar that he made many attempts to get this proof with no very great success, but that he did succeed in obtaining a table under circumstances leading to the belief that others were concealed for the purpose of extorting money from the Somalis.

"The object of such concealment is obvious, as, if the proof were forthcoming, the Sómál would be regarded as 'Shuruf,' or descendants of the Prophet, which would necessarily be galling to the present claimants of the honour in Arabia and elsewhere, who now look down on the Sómál as being of a lower race."

According to the Somalis, the two races inhabiting the country now called Somaliland are denominated Asha and Hawiya, from the former of whom the present Somalis spring. The Hawiya are not allowed to be Somalis at all, and are stated to be of pagan descent. The real Somalis are the Darod (Ogaden, Dolbahanta, Mijertin, Marehan, etc.), and the Ishak (Habr Toljaala, Arab, Habr Gerhajis, Habr Awal, etc.). The Aysa (or Esa) Gudabürsi and Hawiya are not counted as Somal by the Somalis themselves.

IV. The Gadabürsi Country.

The Somali coast is reached from Aden either by chartering a native *bugalow*, or by taking a passage on one of the small cattle steamers, owned by Parsee firms, that make the voyage almost weekly to Zeila, and, touching at Bulhar when the surf will permit a landing, proceed to Berbera, where the cargo of sheep and cattle is taken on board for Aden. On each of the four occasions when I crossed the Gulf of Aden our party numbered three or four, and it was worth our while to charter one of these boats for a direct crossing. The first time,

although warned of the difficulty of landing anywhere but at Zeila or Berbera, we were successful in getting ashore at Bulhar. From thence we started, on January 14th, 1896, with a caravan of about fifty camels, and an escort of about twenty rifles, for the Gadabürsi country, leaving the Elmas mountains on our right and passing through a beautiful and luxuriant bush and grass country till we reached the Durdurhaat valley. Within three days of the coast we came upon a herd of about forty elephants, but as they were all cows and youngsters they did not tempt us out of our course, and we continued our journey northwards along the northern edge of the Bur Maado and Simodi ranges to Aliman. We found all this country thickly inhabited by the Gadabürsi, and here alone, in Northern Somaliland, we had the companionship for days together of a running stream.

No part of Somaliland that I have visited is more beautiful than this tract of country, watered by an almost perennial stream, now lined with great trees festooned with the *armo* creeper, now with the high green elephant grass or luxuriant jungles, and guarded by woody and rocky mountains on the left hand and on the right. Between the Tug or Wady and these hills the country had a park-like appearance, with its open glades and grassy plains. But the new and varied vegetation of Africa was not the only object delightful to the eye: countless varieties of birds, hawks, buzzards, Batteleur and larger eagles, vultures, dobie birds, golden orioles, parrots, paroquets, the exquisite Somali starlings, doves of all sorts and sizes, small and great honey-birds, hoopoes, jays, green pigeons, great flocks of Guinea fowl, partridges, sand grouse, were ever to be seen on every hand, and, while the bush teemed with Waller's gazelle and dik-diks, the plains with Sœmmerring's antelope, with a sprinkling of oryx, our road up the Tug was constantly crossed by the tracks of lions, elephants, leopards, the ubiquitous hyæna, and other wild beasts.

On the 19th of January we reached a bifurcation of the Tug. We took the northern valley, marching up the dry bed of the Araweina Tug, leaving the Durdurhaat river, which now disappeared in the deep ravines of the high mountains to the south. On the 20th we reached Aliman, one of those places marked so large on the map that the unwary traveller might expect to find a walled town. But Aliman is but a very dirty-looking pit, at the bottom of which is some black and very nasty water. At Aliman we separated from Mr. Buxton and went south through the mountains until we struck the Durdurhaat river again: keeping the river-bed as our road, we wended our way through mountainous country, the ravines through which we passed often covered with forests of *hasaaden*, a giant species of the candelabra euphorbia. On the 25th of January we emerged from the mountains, and on the 27th we reached the Great Harrowa valley, a sea of jungle stretching between two parallel ranges far away into Abyssinia. We had seen no trace of inhabitants since leaving Aliman, the whole country being burnt up and destitute of pasture.

After a few days' rest we made our way through the chain of hills that bound the northern limits of the waterless Howd, and camped on

the edge of the Marar prairie, within view of the isolated rocks known as Jifa Madir and Jifa Uri. For the first time in my life I saw the game as I had heard it described by African travellers; thousands of Sœmmerring antelope, hartebeeste, and oryx were in view. Every day we saw ostriches, quantities of bustard, the hills behind were tracked with elephants, and, though game was almost too plentiful to call it a sportsman's, it was certainly a naturalist's, paradise. Any morning or evening it would have been easy to shoot any number of *aoul* (*Gazella Sœmmerringi*) from our camp, they were so tame. Here our scouts brought in news of both Gadabürsi and Midgan *kurias* being in the neighbourhood, and we soon opened up communication with them.

The Gadabürsi, in whose country we had been for some weeks, have the character of being amongst the wildest of the Somali tribes; they, and the Aysa and Hawiya, are not recognised as pure Somalis by the Darod and Ishak sections, those other tribes of the race inhabiting the east and south who trace their origin, the one from Sheikh Jiberti bin Ismäil's son Darod, and the other from Sheikh Ishak bin Ahmad, a cousin of the Prophet's. The Gadabürsi are descended from the Sämärōne, and Gadabürsi is but a nickname. The Gadabürsi probably number some 40,000 spears:—

Rer Makahil	12,375
Jibril Yūnŭs	3,450
Adan Yūnus	2,590
Nur Yūnus	9,940
Mahomed Āsa	9,320
Habr Affan	5,600

Scarcely anywhere else have I seen natives still wearing skins. The Gadabürsi we met still observed the custom of the ostrich feather, wearing one in the hair for each man killed, and not being permitted to marry till four feathers could be worn. The guide we secured wore seven by right, and confessed to two having been won by the murder of two men asleep under a tree, and these he pointed out with pride and satisfaction! Unlike the tribes east and south, who carry two spears, the *warran waine* and the *haughto*—a throwing spear and a jobbing one, the Gadabürsi carry one large stabbing one, as do the Aysa. Except for being somewhat wilder, rougher, and inferior in appearance, they do not differ very much in their customs, language, and habits from their neighbours.

The remainder of our journey was made along the northern edge of the Howd, and we returned to the coast *viâ* Hargaisa and Argan, by the Jerato pass through the Golis range, under the magnificent mountain of Gan Libah (alt. 5200 feet), and across the maritime plain to Berbera.

V. Second Expedition: Western Ogaden.

The second expedition I made with my wife in the company of Sir Edmund Loder, who had been my companion on several former occasions

in the Sahara, the Tunisian Djereed, and the Aures ranges: we crossed the maritime plain and the Golis range to the north of Gan Libah through the Jerato pass.

We spent a week, before crossing the Howd into Ogaden, with Lord Delamere, who was preparing for a much more important journey to Lake Rudolph. We occupied our time mostly in "pig-sticking" the old warthogs on the Ooanouf plain; of these there were quantities, giving excellent runs, but often going to ground in the deep earths under the ant hills. I mention this, as on several occasions we galloped an animal that was new to us to ground, one of which I sent to the coast to be shipped for Aden and London; but it died on the voyage. I think it is identical with the Aard wolf of South Africa—the Somali call it *Waire*, or *Waira*—an animal that has long been a puzzle to zoologists, but is now, I believe, regarded as the solitary representative of a distinct family, *Proteles cristatus*. I should myself be inclined to class it with the *Hyænidæ*. After having our Christmas dinner together we left Lord Delamere, and, following practically the route of the two Jameses, Aylmer, and Mr Lort-Phillips, in 1885, we crossed the waterless Howd in seven days, reaching the Darror pool on New Year's Day 1897.

Darror pool figures in most maps; it is nothing but a depression in the bush of some two and a half acres that holds the stagnant water of the last rainy season till the middle of January, after which it is usually dry. Therefore, any one who takes this route across the Howd should make inquiries of the natives as to the condition of the pool before starting, for, needless to say, any miscalculation as to water is a most serious thing in this country. We had some seventy camels and sixty souls, besides horses, milch goats, and sheep, and therefore water was of the greatest importance to us. You are perhaps told that you will reach the water in six days, and when the sixth day comes and no water, you march the seventh day with considerable anxiety. At Darror we found about three inches of slimy water, round which the Rer Ali Ogaden had their *karias*. There were some 400 camels standing in the pool, natives wading it, women washing their *tobes*, and our delight at seeing the water was somewhat tempered when we realised that for many days to come we should have to drink it and cook with it. By repeated boilings, skimmings, precipitating with alum, and filtering, we obtained a fairly clear and tasteless liquid. It is a curious fact that the natives never suffer from typhoid or enteric fevers as a result of drinking this foul and putrid water, even though they use it for months together.

From Darror, after loading up a week's supply of this nectar, we made a short journey north, to a district where lions were numerous, and where we first came on rhinoceros tracks. Thence we worked our way south for hunting, through open plains covered with *dhur* grass, and through fine forest and jungle, and then, bending north and west, we made Awaré. Before getting there, the presence of birds and wheeling buzzards and hawks over the trees, proclaimed the welcome news that there was water in the pool.

On the 19th of January we reached Milmil. There were but few natives in the neighbourhood, but they informed us that an Englishman

was three days distant, having been to the Tug Sulul, and that he had come away after having had two of his men taken prisoners by the Abyssinians. This was unpleasant news, as we had made up our minds to go to Bourka, still farther west. We sent some of our men on to see if they could find the Englishman, whom we knew must be Mr. Greenfield. They returned in a few days with the news that he had gone back to the coast. Subsequently we had the true version of Mr. Greenfield's adventures; instead of anything having occurred that would make our course more difficult, we found that he had, after rescuing his men and making friends with the Abyssinians, extracted a promise from them that they would show kindness to any people of "his tribe" they might meet. However, with such information as we had then, we decided to make for our original point, but taking every care to avoid any Abyssinian posts.[1] We marched from Milmil and camped in the Fulful valley, and then in the Deghabour Tug, which comes down the Jerrer valley: the natives here were in a pitiable condition, having been recently looted by the Abyssinians. Thence we marched by Sabatti Waine, an isolated hill near which Lord Delamere was badly mauled by a lion some two or three years ago, one of our deputy headmen pointing out the spot with a grin of satisfaction, and exclaiming, "*I* there when he bite him." We continued down another Tug running west, and camped at Berdahalleh, where there is good water; then we marched for four days across the Tug Fafan and the Sibi desert, till we reached the Tug Sulul at Horoabdulleh. Here we found Grévy's zebra very numerous, and, in spite of all our scheming, ran up against the Abyssinians.

As an instance of how a little turn of bad luck may lead you into Queer Street, perhaps it is worth while to relate the circumstances of our meeting. I had left camp at daybreak to hunt, taking with me as usual my two native *shikaris*, and my pony and *syce*, and had hardly got out of sight of camp, when an unusual scene presented itself. I saw some hundreds of cattle and sheep coming down the Tug in a cloud of dust, and I asked my *shikari*, "What does this mean?" He looked, and said, with a voice full of meaning, "Habasha"—adding that the cattle were Somali loot. Then he added with glee, "See, the Habasha have seen us, and are running away"; and I saw two Abyssinians with rifles, going their best pace on foot into the bush. My feelings were in direct contrast with those of my men, who only saw an immense windfall of loot, and vistas of beef and mutton for two months ahead. My second *shikari* had been in the service of the last Arab Sultan of Harrar, and spoke Amharic and Harrari, and I ordered him on to my pony, with directions to overtake and reassure the fugitives; he did his best, but failed. We then drove down the cattle to camp, and sent our men to track the fugitives, knowing that they would make their way to the Abyssinian post at Melka Deghahamadou, and assert we had looted

[1] Whilst camped at Gagab (Milmil), we saw a most beautiful meteor, which fell as if from the centre of the dome of the heavens to the eastern horizon, leaving a broad track of fire, which did not entirely fade for something like a quarter of an hour.

them. In the meantime we had the cattle and sheep watered, and, without listening to our men's appeals to take at least some of the plunder, we had the whole sent under escort to Melka Deghahamadou, my second *shikari* going as interpreter. All's well that ends well; on our return to camp the next afternoon I found Mrs. Pease in the most friendly conversation with two Abyssinian military guests, whom she was regaling with the best our stores could afford.

What we foresaw had happened: the soldiers had informed the officer that we had looted them, but within a few hours their lie was proved by the appearance of every head of cattle and sheep. These Abyssinians were all armed with the Italian magazine rifle of 1894 (part of the loot of Adowa), and each carried 100 rounds of ammunition. They were very proud of their weapons, and certainly our men's Sniders, rifles, and carbines were a sorry contrast.

Our visitors were very dark, cheery little men. One of them, who had been perforated by Italian bullets at the battles of Macalle and Adowa, gave us an interesting account of his adventures. The Abyssinians call themselves Kristâns—the Gallas of these regions are pagans; the Christianity of the Habasha, as far as I could learn, is little more than a licence to indulge in drunkenness and vices forbidden to their Moslem neighbours. The only signs of curiosity that they displayed with regard to ourselves were excited by the seal I put on a letter addressed in Arabic to the officer, and by my wife's butterfly net. They asked how the lady wore the latter, and displayed almost childish delight on being presented with a stick of red sealing-wax and seeing it used; they, however, explained that no doubt the "Lion of Judah" had some like it at Addis Abeba.

From Horoabdulleh we continued west across several ranges of stony hills, and without anything noteworthy occurring except the discovery of a very distinct crater of an extinct volcano, in a valley strewn with lava. On the 6th of February we reached the Dahato valley, and saw for the first time the Bourka mountains looming blue beyond. But several circumstances forced us to abandon all hope of penetrating this practically unknown country. In the first place, it would be necessary to leave the greater part of our caravan and camels in the Dahato valley, as four miles beyond our camp the fly-country began. In most seasons the fly extends as far east as the Tug Sulul; but this year, after careful inquiries of the Mellingour Ogaden, we satisfied ourselves that there was no fly east of the Dahato river, and, on making the well-watered plain, we found it peopled with numerous *karias*, and with herds of camels, sheep, and cattle, in the green grass. So accurately do the natives know the limit of the fly, that here, within about three miles of the dreaded pest, the people felt absolutely secure, whilst beyond, none but a few gum hunters on foot ever penetrated. In the second place, even if we had had the time to collect donkeys—which share with mankind one quality at least, that of being fly-proof—or camels that we were prepared to sacrifice to the fly, we hardly liked to subject my wife to the choice of being left alone with our main camp, with unknown risks from natives and Abyssinians, or of facing the probable discomforts of a meagre

equipment such as would be necessary if we went in on foot. Again, we had not been forty-eight hours in the valley before our messenger on our fast-trotting Aden camel, whom we had sent to the coast with our mail seventeen days before, turned up with a most alarming letter of recall from the Aden authorities, urging us on no account to go west of Milmil, and ordering us to put ourselves at once in touch with Berbera, and to avoid the Ogaden and the Milmil-Hargaisa route across the Howd. With the same message came a letter informing me that I had been a candidate, and a telegram to Aden that I was elected as M.P. for Cleveland. The emotions that the last astonishing piece of news aroused were put for a time in the shade by the alarming despatches from Aden and Berbera. The least we anticipated was that Berbera was invested, and Hargaisa occupied by Ras Makonnen. This eventful mail determined us to march at once, and turn our backs on the promised land, and to leave to an indefinite future the attempt to explore the blue mountains of Bourka.

Before alluding to our return journey, I may mention that there was a Galla town within an hour of our camp, and that the Somali natives here were most friendly. They, like all the Somalis of this side, are curiously light in colour, few being much darker than a pale *café au lait* tint.

We had no adventures till we got to Milmil, where we found ourselves in some difficulty, owing to the fact that we were not to take the Hargaisa route, and the water-pits at Awaré and Darror had long been dry. Besides this, we had been expecting a supply of provisions for our men—with camels we had sent to Berbera some weeks before—and supplies had run out. We did not like to abandon this little caravan to the tender mercies of the Rer Ali, who had swarmed in from the Awaré and Darror country, and who were not showing themselves well disposed towards us. Fortunately our camels and stores turned up, after some days' anxious waiting, and we struck across the Howd, making Awbahadleh in nine days without water. As an instance of the endurance of Somali ponies, I may mention that during these nine days of long marches in hot weather, with little time for pasturing, our five ponies had water only twice, viz., one and a half buckets each on the third day, and two buckets each on the sixth day, and, except for a tucked-up appearance, they were not appreciably weaker at the end. On reaching the western watershed of the Golis range we considered we had carried out our instructions, and were practically in touch with Berbera, and we took a week's rest in camp at Argan, where I had been the year before. The Golis here run out, and finish with several valleys running west; the last ridges of the range end somewhat abruptly, whilst beyond are a few isolated hills and rocks, or *koppjes*, with broken plains towards Hargaisa.

Like most Somali expeditions, ours had been made chiefly with a view to making as complete a collection as we could of the varieties of Somali big game. Our bag included:—Greater Kudu (*Strepsiceros koodoo*), Lesser Kudu (*Strepsiceros imberbis*), Swayne's Hartebeeste (*Bubalis Swaynei*), Clarke's Gazelle, *Dibatag* (*Ammodorcas Clarkei*), Waller's Antelope (*Litho-*

cranus Walleri), Sœmmerring's Antelope (*Gazella Sœmmerringi*), *Gazella Spekei*, *Gazella Pelzelni*, *Oryx beisa*, Klipspringer (*Oreotragus saltator*), *Gelass* (*Madoqua Phillipsi*), *Guzli* (*Madoqua Guntheri*), Baira Antelope (*Oreotragus Megalotis*), Wart Hog (*Phacochœrus Æthiopicus*), Rhinoceros, Grévy's Zebra (*Equus Grevii*), Somali Wild Ass (*Equus Nubianus Somalicus*), Golis Baboon (*Cynocephalus Netcho*), Elephant, Lion, Leopard (*Felis pardus*), Serval (*Felis serval*), Cheetah (*Cynalurus Guttatus*), Striped Hyæna (*Hyæna striata*), Aard Wolf (*Proteles Cristatus*), Spotted Hyæna (*Hyæna crocuta*), Jackal (*Canis pallidus*), Wild Dog—*Yea* or *Yeri* (*Lycaon pictus*), and smaller animals, game-birds, hares, mongooses, varieties of rock-rabbits, etc.

VI. Geological.

I am too ignorant of geological knowledge to venture on a description of the geology of Somaliland, though we made one or two discoveries of some interest. In a paper of Dr. Gregory's in the *Geological Magazine* (Decade IV., vol. cxi., No. 385, p. 289, July 1896), based on the collections made by Mrs. E. Lort-Phillips, Miss Edith Cole, and Mr. G. Percy V. Aylmer, there is a good summary of the general formation of the country between Berbera and the Golis; but unfortunately it leaves out any particular account of those western and south-western parts of the country, between Gan Libah and Bourka, with which I am most familiar, for the very good reason that probably no one qualified to describe it has ever been there.

"South of Berbera there is a low plain of recent marine deposits mostly covered by blown sand and soil. Eight miles inland is the first of a series of east and west ridges which form the Maritime mountains; these extend for about twelve miles. Then follows the 'Inland plain,' which is a continuation of the Coast plain; it ends abruptly at the height of 1800 feet at the foot of the north scarp of the Somali plateau." This plateau is reached, towards the eastern end of the Golis range, by the Sheikh pass, at the height of 4000 feet, and at the western end by the Jerato pass, just west of Gan Libah (5200 feet).

"East and west of the Sheikh pass the north edge of the plateau is much higher, rising at one point to 6819 feet.

"To the south of the Golis the plateau descends gradually across the Howd to the valley of the Webbe Shebeyli.

"The Maritime and Inland plains are both occupied by alluvium, marine and subaërial. Through these rise three ridges; the first two are formed of limestone. That at Bihin is unquestionably Lower Oolitic and no doubt Bathonian. That at Duba may be a part of the same limestone, or a later one, possibly Neocomian in age."

The highest and farthest inland of the three ridges consists of archæan gneisses, and is an outlier from the main Somali plateau. The Somali plateau consists, in the main, of a mass of gneiss and rocks of the archæan series. The archæan series is penetrated by pegmatite dykes of the same type, but coarser in grain, than those of British East Africa. It is capped by two rocks of two series: (1) red and purple unfossiliferous

sandstones often passing into impure hæmatite; (2) some limestones associated with beds of chert, probably of Neocomian age.

"It is most probable," says Dr. Gregory, "that the Jurassic rocks of Somaliland are part of a band which once extended eastward into the Indian Ocean, and may have been part of the hypothetical continent of Gondwana Land, or Lemuria. This continent was probably separated from Equatorial East Africa, but was connected with the Cape."

In the valleys running west out of the spurs of the Golis, in the Argan district, I found some fine beds of marble in one or two of the rivers. The existence of marbles I have not seen noticed before. Another discovery of some importance was that of a valley some fourteen miles west of the Tug Sulul, called Durie Waine (Big Dirt), in which was a sharply defined extinct crater, with large beds of lava down to the black igneous rocks of the river bed. The diameter of the circle of the inside of the mouth of this crater was not more, I think, than 100 feet, and the depth of the inverted cone about thirty-five or forty-five feet. The vegetation all round the western side was most luxuriant, and bushes grew in the bottom of the crater, but on the hillside of the crater the soil was of a curious powdery nature, with but a few bushes, and those very sickly.

In the next valley, amongst white cliffs, we found a deep perennial spring of very sulphurous water. The name of this district is Duriedufân, which is rather suggestive of its condition: *durie* means dirt, and *dufân* grease left round the mouth after eating, which, when the proximity of the crater is considered, makes it, if not a very picturesque, a very appropriate, name.

This is the first notice, I believe, of the existence of any volcanic rocks in this region, and, though we were approaching the volcanic regions already known to geographers and geologists, the fact that volcanic action has been discovered so far east and north is probably of importance.

VII. Archæological.

There are several archæological puzzles in Somaliland on which I have not time to dwell. There are, as far east as Eik, ruins of stone-built towns, probably of Galla construction. Mr. Seton Karr has made a very interesting collection of palæolithic implements made by a people that possibly lived 300,000 years ago, to quote Sir John Evans. It is said that these implements, the use of which is not clear, are peculiar in being as perfect as the day they were made, owing to the absence of any wear from river action.

VIII. Conclusion.

In conclusion I may express a hope that if this little corner of Africa is responsible in any degree for the Prime Minister's charge that "Africa is the plague of the Foreign Office," the day may arrive when the British connection with it may prove to be one of those blessings which are often temporarily disguised. I fear there is a tendency at home to deny its

value, or at least to underestimate it. But I believe that—like the upper valley of the Nile, which is now rightly regarded as a most important region, and which a few years ago was not considered worth securing—these parts may come to be regarded as of great political importance, with reference not only to Aden, but also to the Egyptian Red Sea littoral and the northern part of British East Africa. I feel confident that water may be found, as in the Sahara, by artesian wells, in all the Tugs of the maritime and inland plains, and that the date-palm and other cultivation could be rendered possible, whilst the soil inland is undoubtedly richer. Much could be done to foster a trade which already yields a surplus to the revenues of Zeila. Somaliland is capable of producing and exporting vast quantities of sheep and camels; the latter would be most useful in supplying the present scarcity of transport in India. In the absence of a railway, the route from Lake Rudolph to Berbera is the best transport route from the inland regions of northern British East Africa, the whole distance being practicable for camels and free from fly.

Yet in view of the policy being pursued at this moment there is little ground for any hope that anything will be done to promote our interests, or those of the natives. If the Indian Exchequer, under the stress of present calls upon it, is unable to bear the burden of the responsibilities that pertain to the administration of Somaliland, the Protectorate might be transferred to the Colonial Office, whilst retaining the services of those trained officers that only India can provide, and who have performed their difficult task hitherto with magnificent success. That we should give up a portion of our territory to purchase some more important advantage elsewhere is a comprehensible policy, but in any case any one familiar with Somaliland, its people and its possibilities, can only deplore the prospect of the imminent ruin of British trade and influence, and of the brave race who have been taught to look to us for protection and will look to us in vain.

THE CLIMATE OF CANADA.

By Professor R. F. Stupart,

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(*Read at the Meeting of the British Association, Toronto,* 1897.)

In the Dominion of Canada, a country embracing one-half of the continent of North America, we naturally find a very diversified climate: on the Pacific coast, with the ocean on the one side and lofty mountain ranges on the other, it is moist and temperate; while on the east side of the Rocky mountains, on the high, level plateaus of the North-West Territories, and in Manitoba, is found a climate with large extremes of

temperature, but withal a bright, dry, bracing, and healthy atmosphere. In the valleys of the St. Lawrence and Ottawa rivers, a cold, but bright, bracing winter is followed by a long, warm, and delightful summer, while the maritime provinces, lying between the same parallels of latitude as France, and with shores laved by the waters of the Atlantic, rejoice in a climate the praises of which have been sung by successive generations of their people from the old Acadians to the present day.

The climate of Vancouver Island, as of all other parts of British Columbia, varies much with the orographic features of the country. The annual rainfall along the exposed western coast of the island and thence northward to Alaska is very great, exceeding 100 inches. At Carmanah, just at the entrance to the Straits of Juan de Fuca, the average of five years is 112 inches. At Port Simpson an average of ten years shows 108 inches. At Quatsino, half-way up the coast, in 1896 there were 108 inches, and at Rivers Inlet, on the mainland north of Vancouver Island, 104 inches. In the south-eastern part of the island between Victoria and Nanaimo, a district sheltered by the island mountains, the climate does not greatly differ from that found in the north of England. Not only does the annual mean average temperature agree very closely with that of parts of England, but the mean average of corresponding months is nearly the same. The rainfall is, however, more seasonable in its character. May to September is usually a comparatively dry period, while copious rains fall between October and March.

Crossing the Straits of Georgia to the mainland, we find a fine warm summer, and a winter increasing in severity as we ascend the Fraser valley and get to higher levels. At Agassiz, on the Lower Fraser, about seventy miles from Vancouver, is situated one of the Dominion experimental farms; the average mean temperature of January at this place is 33°, and of July 64°, with a daily range of 10° in the former month and of 26° in the latter; the lowest temperature on record is −13°, and the highest 97°. Frosts seldom occur in May, and there is no record of any during the summer months. The annual rainfall is 63 inches, 64 per cent. of which falls between October 1st and March 31st. This shows very approximately the climate of the Lower Fraser valley.

To the eastward of the coast ranges the climate changes. The prevalent westerly winds from the Pacific are deprived of much of their moisture on the western side of these ranges, and then eastward to the Selkirks, in Kootenay and Yale districts, the rainfall and snowfall are nowhere great, and at some places are very scant. The annual range of temperature is large, as is also the daily range during the summer months. Extremely low temperatures are occasionally recorded in the winter, and decidedly high temperatures are not infrequent in summer. The Chinook or *Foehn* effect is very marked in these regions, and temperature changes are at times very rapid.

The accompanying table shows the temperature found at four stations in British Columbia.

TABLE I.—The average mean highest, mean lowest, and mean temperature; the highest and lowest temperature and mean daily range; also per cent. of cloud and precipitation.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
VICTORIA.													
Mean highest, . .	41·7	43·8	50·1	54·7	61·6	65·3	69·6	69·0	63·3	56·0	48·1	45·7	55·7
Mean lowest, . .	32·7	33·6	36·6	39·3	44·1	47·6	49·5	49·5	45·9	42·9	38·2	36·8	41·4
Mean temperature, .	37·2	38·7	43·3	47·0	52·8	56·5	59·6	59·3	54·6	49·5	43·2	41·3	48·6
Mean daily range, .	9·0	10·2	13·5	15·4	17·5	17·7	20·1	19·5	17·4	13·1	9·9	8·9	14·4
Absolute highest, .	56	60	68	74	82	86	89	86	80	70	60	59	89
Absolute lowest, .	−1	6	20	24	30	36	37	37	31	22	18	8	−1
Per cent. of cloud, .	77	79	67	70	59	56	43	36	59	67	77	79	64
Precipitation, . .	5·13	3·53	2·57	2·11	1·21	1·16	0·46	0·59	1·98	3·11	6·13	7·53	35·51
AGASSIZ.													
Mean highest, . .	37·9	43·5	52·0	55·2	62·9	69·5	76·7	79·0	67·4	61·3	44·4	40·8	57·5
Mean lowest, . .	28·2	31·7	35·9	38·3	44·8	48·3	51·0	50·5	46·7	42·1	34·1	31·9	40·3
Mean temperature, .	33·0	37·6	44·0	46·7	53·9	58·9	63·9	64·7	57·0	51·7	39·3	36·3	48·9
Mean daily range, .	9·7	11·8	16·1	16·9	18·1	21·2	25·7	28·5	20·7	19·2	10·3	8·9	17·3
Absolute highest, .	57	64	74	82	90	95	95	97	90	82	73	58	97
Absolute lowest, .	−13	−12	16	28	30	36	38	38	32	29	9	8	−13
Per cent. of cloud, .	62	62	56	60	55	52	35	30	43	55	67	67	54
Precipitation, . .	7·29	6·68	5·47	5·49	4·85	3·97	1·55	1·62	5·25	6·56	8·69	9·43	66·85
KAMLOOPS.													
Mean highest, . .	29·6	33·0	49·1	59·8	68·2	77·3	82·9	83·0	69·6	56·8	39·5	34·6	56·9
Mean lowest, . .	15·0	15·6	27·1	36·7	45·3	49·9	54·6	53·6	44·6	38·6	27·2	23·3	36·0
Mean temperature, .	22·3	24·3	38·1	48·2	56·8	64·6	68·8	68·3	57·1	47·7	33·3	29·0	46·5
Mean daily range, .	14·6	17·4	22·0	23·1	22·9	27·4	28·3	29·4	25·0	18·2	12·3	11·3	21·0
Absolute highest, .	56	64	69	75	86	101	101	97	87	82	65	56	101
Absolute lowest, .	−27	−27	−5	24	26	39	44	39	31	16	−22	−17	−27
Per cent. of cloud, .	72	67	50	62	70	55	47	33	52	52	73	79	59
Precipitation, . .	0·75	1·26	0·63	0·50	1·45	1·49	1·42	0·53	1·00	0·72	1·00	0·80	11·55
MISSION VALLEY.													
Mean highest, . .	28·9	36·6	45·8	58·1	64·9	74·0	81·2	80·3	63·9	54·9	37·5	33·1	54·9
Mean lowest, . .	14·7	19·8	23·9	31·9	39·6	42·9	46·8	44·8	37·5	30·4	23·3	21·6	31·4
Mean temperature, .	21·8	28·2	34·8	45·0	52·2	58·4	64·0	62·5	50·7	42·7	30·4	27·3	43·2
Mean daily range, .	14·2	16·8	21·9	26·2	25·3	31·1	34·4	35·5	26·4	24·5	12·2	11·5	23·3
Absolute highest, .	46	55	65	79	86	94	98	95	82	74	56	47	98
Absolute lowest, .	−10	−15	−6	14	25	29	32	31	20	16	−17	−12	−17
Precipitation, . .	1·33	1·05	0·23	0·64	1·57	0·89	0·38	0·23	1·51	0·70	1·90	1·85	12·28

The climate of those portions of the Territories which lie near the mountains is one of peculiar interest, presenting as it does features which are unknown in countries nearer the sea and away from the mountains. Among the marked features are the rapid changes of temperature which frequently occur in short intervals of time; the great variations in different years, both of the mean temperature of the winter season and of the summer rainfall; also the fact that the summer season in the Great Mackenzie basin, just under the Arctic circle, is nearly as warm as in Alberta.

The phenomenon of the rapid changes in short intervals is accounted for and explained by the now well-known Chinook or *Foehn* effect, which is met with to a greater or lesser extent under the lee of mountains on the windward side of which moisture is precipitated. For long it was not understood why comparatively warm ocean winds should often, blowing across high cold mountain ranges, descend on the other

side at a higher temperature than when at sea-level. Some years ago Dr. Hann of Vienna was the first to explain the enigma as due to the retardation in the rate of cooling of the air during ascent, caused by the condensation of moisture, and subsequently the mechanical heating by compression in descent on the other side of the mountains. Speaking of the *Foehn* near the Alps, he says: — "Leaving out of consideration the cooling which goes on by the way, partly by radiation, partly by contact with mountain masses, a simple calculation will give the result that the temperature of a south wind will be about as many half degrees centigrade higher at the north foot of the Alps than at the south foot as the height of the mountain chain contains hectometres, for it is lowered half a degree for every 100 metres ascent, but raised one degree for every 100 metres descent." The normal conditions over the middle and higher latitudes in the winter are high pressure over the continents and low pressure over the oceans, which conditions are obviously not such as will produce the Chinook wind; but the normal conditions are at times broken by storm-centres moving to this continent from the Pacific, and it is when the movement of a storm-centre causes a south-west and westerly flow of air across the Rocky mountains from the Pacific that the Chinook blows over our western prairies. Sometimes a change of wind from north and north-east to south-westerly will, in Alberta, mean a rise of temperature from, perhaps, −30° to 40° in a few hours.

The variableness of seasons, while not entirely, is certainly to a very great extent, due to the varying position of the mean track of storm-centres in different years. The average mean track for January, deduced from many years, is across southern British Columbia; but in some winters the centres persistently move farther south than in others, and pass into the continent over Washington or Oregon States, and then the Chinook does not blow east of the mountains in the Canadian territories, but north-east and north winds prevail, accompanied by continued low temperature. In other years the storm-centres just as persistently move across northern British Columbia, and then the Chinook is the rule rather than the exception, and the weather under the lee of the mountains keeps mild. As examples of this variableness, the mean temperature of January, 1886, at Edmonton, was −13°·4, while in 1889 it was 21°·9—a range of 35°·3. In February, 1887, it was −10°·4, and in 1889 21°·9, a range of 32°·3; in November, 1896, it was zero, and in November, 1890, it was 38°. All other stations in Alberta show very similar variations, which are much greater than the difference between normal values for the warmest and coldest months at stations on the Pacific Coast. Example: Victoria normal temperature for January is 37°, and for July 60°—a range of only 23°. In the summer months, on the other hand, the range of temperature at these stations under the mountains between different seasons is as small as at stations on the coast.

Moving northward in the Mackenzie river basin we find that during the greater portion of the year the temperature diminishes as the latitude increases. January on the average at Fort Dunvegan is 14° colder than Edmonton, and at Fort Chipewyan is 22° colder; later, as the

spring advances, these differences become less, and by the end of May and during the following three months pretty uniform temperature prevails in Alberta, the Peace river, and northward almost to the Arctic Circle. In September the differences again become apparent, and reach a maximum in December or January.

Near the mountains signs of spring multiply as April advances, but in the eastern portion of Athabasca and thence to Hudson's Bay, together with all the northern portions of Keewatin, winter lingers until quite the end of the month. In April the 40° mean temperature isotherm passes through Alberta and Assiniboia, while an average daily maximum of 58° in southern Alberta gradually lowers northward and eastward until 50° is reached at Prince Albert and near the boundary of Manitoba; this indicates a spring slightly in advance of that of south-western Ontario. Spring in this month also makes rapid strides in Manitoba, where the average mean temperature is from 35° to 37°, and the daily maximum about 11° higher.

The mean temperature for July at Winnipeg is 66°, and at Prince Albert 62°. The former temperature is higher than in any part of England, and the latter is very similar to that found in many parts of the southern counties; the diurnal range, however, is different from any found in England, the average daily maximum temperature at Winnipeg being 78°·1 with a minimum of 53°·4, and at Prince Albert a maximum of 76° with a minimum of 48°, and owing to these high day temperatures, with much sunshine, the crops come to maturity quickly.

In considering the climates of the Canadian prairies, the fact should not be lost sight of that, although the total annual precipitation only averages 13·35 inches for the Territories and 17·43 inches for Manitoba, the amounts falling between April 1st and October 1st are respectively 9·39 inches and 12·87 inches, or 70·3 and 73·9 per cent. of the whole. The average in Manitoba, 12·87 inches, is not far short of the average for Ontario during the same six months. As in Ontario, much of the rain in summer falls during thunderstorms, which, however, are of but moderate energy, and it is but very rarely, if ever, that the country is visited by tornadoes, such as are common on the more southern prairies.

The Province of Ontario can boast of as many distinctly different climates as can any country in the world. That part of the Province which lies immediately north and north-east of Lake Superior, and which forms the northern watershed of that great lake, has a long cold winter, and at times extremely low temperatures are recorded; indeed, scarcely a winter passes without 50° below zero being registered at White river, a station on the Canadian Pacific Railway. As a rule the snow does not disappear from the woods until the beginning of May, after which time, however, the summer advances very rapidly, and four months of superb weather follow. Travelling east and south-east the climate quickly improves, and in the valleys of the Ottawa and the upper St. Lawrence we find a moderately cold winter, but a singularly exhilarating, bracing atmosphere, which makes a zero temperature by

no means unpleasant. Signs of spring are not wanting; early in April and by the beginning of May foliage is well advanced, and then follows a decidedly warm summer. The whole of this region is, between the middle of May and middle of September, included between the same isotherms as the greater portion of France, and, after a protracted autumn, winter sets in again in November. The mean annual temperature of Montreal is 41°·8, and of St. Petersburg 38°·7. A comparison of the annual curves for the two places is interesting: the mean for January at Montreal is 5° lower than at St. Petersburg; in February it is but 1° lower, and then the Montreal curve steadily rises above the other until in August it is 6° higher; after this the two curves draw together and by December are coincident.

In the peninsula of Ontario, or that portion of the Province which lies east of Lake Huron and north of Lake Erie and the western portion of Lake Ontario, the winters are by no means severe, and the summers are seldom oppressively hot, this being due to the tempering influence of the lakes by which this part of Ontario is surrounded. In the western counties the April mean temperature corresponds nearly to that of southern Scotland, and in May the mean temperature of the whole district is slightly higher than for the south of England. The temperature conditions during the summer months may, as in the Ottawa and upper St. Lawrence valleys, be compared with those of France, the normal temperature for July ranging between 66° and 72°. September and October are generally delightful months, and seldom does snow remain on the ground until well on in December, except on the high lands of the interior counties. That portion of Ontario which lies immediately east of the Georgian Bay, the District of Muskoka at an elevation of 700 feet above the sea, abounding in small lakes, possesses a wonderfully bracing atmosphere, which, with a very high percentage of bright sunshine and a pleasant temperature, has made this region a summer resort much frequented by people from the cities and towns farther south.

The annual precipitation of the entire Province lies between 30 and 40 inches, which is fairly evenly distributed throughout the year; in summer, however, the rain generally falls in thunder-showers, and cloudy and wet days are of rare occurrence. The accompanying table shows the average climatic conditions at Toronto, based on a record of fifty-six years.

The summers in the south-western part of Quebec are as warm as in the greater part of Ontario; in July the 70° isotherm passes not far south of Montreal, the 65° line passes through Quebec city, and most of the Gaspé peninsula has a mean temperature somewhere below 60°. The winters throughout the Province are cold, and between December and March the ground has usually a deep covering of snow.

The importance of the covering of snow during the more severe winter weather cannot be overestimated, as it protects the roots of trees and herbage, and, besides this, enables those engaged in the lumbering trade in the northern parts of the Provinces to get the timber from the

TABLE II.—56 Years.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
TORONTO.													
Mean temperature (56 years),	22·4	22·5	28·7	41·0	52·1	62·4	67·6	66·2	58·6	46·4	36·1	26·3	44·2
Absolute highest,	57·5	58·8	70·3	89·8	93·4	93·4	98·0	99·2	93·6	80·7	67·0	61 0	99·2
Absolute lowest,	−26·5	−25·4	−15·6	5·9	24·6	28·1	38·7	40·0	27·9	15·9	−5·0	−21·0	−26·5
Mean highest,	28·9	29·6	35·6	48·9	61 3	69·6	77·4	75·6	65·5	54·1	42·0	32·2	..
Mean lowest,	14·9	14·5	21·4	32·8	42·9	50·4	57·9	57·0	47·9	38·7	29·9	19·6	..
Monthly and annual ranges,	51·3	51·8	49·3	48·2	46·5	46·3	42·4	42·2	46·8	44·1	44·3	49·8	103·0
Mean daily range,	14·0	15·1	14·2	16·1	18·4	19·2	19 5	18·6	17·6	15·4	12·1	12·6	16·1
Greatest daily range,	40·9	42·8	39·6	52·1	44·2	41 8	44·5	39·1	44·6	39·3	32·4	36·0	52·1
Average height of bar. at 32° Fah.,	29·648	29·649	29·606	29·597	29·576	29·571	29·588	29·617	29·666	29·643	29·624	29·650	29·620
Highest barometer,	30·940	30·516	30·374	30·265	30·214	30·132	30·192	30·042	30·231	30·396	30·592	30·594	30·940
Lowest barometer,	28·166	28·535	28·594	28·704	28·644	28·909	29·101	29·099	28·863	28·731	29·452	28·459	28·166
Humidity of the air,	83	81	78	70	70	73	72	74	77	79	80	82	77
Pressure of vapour,	0·108	0·109	0·130	0·186	0·280	0·418	0·488	0.483	0·393	0·258	0·178	0·128	0·263
Temperature of dew point,	20·0	20·2	24·2	32·7	43·2	54 0	58·4	58·1	52·4	41·1	31·6	23·2	38·3
Amount of rain in inches,	1·16	0 88	1·44	2·18	3·05	2·88	2·99	2·87	3·27	2·36	2·67	1·60	27·35
Number of days of rain,	5	5	6	10	13	12	11	11	12	13	10	6	114
Amount of snow in inches,	17·4	17·0	12·3	2·4	0·1	..	..	..	..	0·7	4·6	13 8	68·3
Number of days of snow,	15	13	11	4	..	..	..	..	..	2	8	14	67
Number of days without rain or snow,	19	16	17	13	12	12	13	12	12	14	18	20	178
Number of days completely clouded,	13	8	6	4	3	2	0	1	2	4	8	13	64
Number of thunder-storms,	0	T	1	2	3	6	7	6	3	1	T	T	29
Number of fogs,	2	2	2	2	3	3	2	2	5	5	3	2	33
Percentage of bright sunshine,	29	34	43	49	48	56	60	58	56	42	28	22	44
Percentage of sky clouded,	74	69	63	58	57	53	49	50	50	62	75	76	61
Number of hours during which the wind blew from N.,	91	76	87	84	90	88	89	94	87	82	75	100	1043
NE.,	72	70	87	81	77	66	49	92	93	89	73	92	941
E.,	58	61	97	129	104	125	62	94	104	86	79	65	1064
SE.,	34	22	30	34	60	62	62	74	44	44	41	25	532
S.,	34	24	45	51	90	99	118	98	77	85	60	27	808
SW.,	147	123	85	67	106	91	126	83	104	122	126	150	1330
W.,	175	168	137	109	96	82	93	86	96	121	169	172	1504
NW.,	131	123	169	162	117	102	139	119	111	112	93	102	1480
Calm,	2	5	7	3	4	5	6	4	4	3	4	2	49
Mean velocity, without regard to direction,	11·4	11·0	11·5	10 7	8·9	7 6	7·6	7·7	8·5	9·1	10·5	11·1	9·6

bush to the banks of the streams on which the huge logs are floated down to the mills, when in the early spring the rapid melting of snow and ice causes a flooding of all watercourses.

The opening of spring in the maritime provinces is usually a little later than in southern and western Ontario and the North-West Territories, and somewhat earlier than in the lower St. Lawrence valley; on the other hand, the summer is more lingering, especially in

the Annapolis valley. The summers are, as a rule, not quite as warm as in western Canada, great heat being seldom experienced, except very occasionally in the inland stations in New Brunswick.

The average annual precipitation of these Provinces is between forty and fifty inches, except along the southern coastline of Nova Scotia, where it is nearly ten inches greater.

The following table, based on the records of twenty-two years, indicate very closely the climate of the three Provinces :—

TABLE III.—The average mean highest, mean lowest, and mean temperature; the highest and lowest temperature and mean daily range; also per cent. of cloud and precipitation.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
CHARLOTTETOWN.													
Mean highest,	24·0	25·3	31·3	41·4	54·8	66·4	71·6	72·2	63·7	52·8	40·1	29·8	47·8
Mean lowest,	6·2	7·0	16·0	27·4	37·7	49·0	56·2	57·1	49·7	40·2	28·3	15·9	32·6
Mean temperature,	15·1	16·1	23·7	34·4	46·3	57·7	63·9	64·7	56·7	46·5	34·2	22·9	40·2
Mean daily range,	17·8	18·3	15·3	14·0	17·1	17·4	15·4	15·1	14·0	12·6	11·8	13·9	13·9
Absolute highest,	50·0	46·7	52·5	67·9	79·3	85·0	87·7	88·0	82·1	73·9	62·8	52·0	88·0
Absolute lowest,	-26·7	-16·8	-14 2	2·4	25·8	35·6	42·0	43·5	34·1	26·2	0·3	-17·9	-26·7
Per cent. of cloud,	61	58	64	57	57	58	53	59	52	70	71	71	61
Precipitation,	4·06	3·25	3·09	2·61	3·06	2·60	3·43	3·96	3·35	4·65	3·74	3·98	41·78
HALIFAX, N. S.													
Mean highest,	30·9	31·6	36·5	46·6	58·4	68·2	73·9	74·3	67·6	56·2	44·2	34·3	51·9
Mean lowest,	13·1	13·9	20·8	29·9	38·9	47·0	54·4	55·4	48·8	39·8	32·2	19·7	34·5
Mean temperature,	22·0	22·7	28·7	38·2	48·7	57·6	64·2	64·8	58·2	48·0	38·2	27·0	43·2
Mean daily range,	17·8	17·7	15·7	16·7	19·5	21·2	19·5	18·9	18·8	16·4	12·0	14·6	17·4
Absolute highest,	54·9	50·0	54·5	76·2	88·0	92·8	93·0	93·1	85·0	79·6	64·5	54·8	93·1
Absolute lowest,	-15·8	-16·9	-9·0	7·2	24·0	32·9	40·8	42·3	32·0	23·4	4·3	-11·2	-15·8
Per cent. of cloud,	62	58	68	59	63	64	57	61	52	63	65	66	61
Precipitation,	5·63	4·94	5·15	4·00	4·43	3·08	3·43	3·96	3·53	5·21	5·26	5·52	54·74
FREDERICTON, N. B.													
Mean highest,	23·3	26·3	35·2	48·9	63·2	72·2	75·9	73·6	65·5	52·3	41·7	27·3	50·5
Mean lowest,	2·8	3·9	16·0	28·1	39·9	49·1	54·4	53·5	44·9	34·4	24·9	9·0	30·1
Mean temperature, (observations each day),	11·8	15·8	25·4	37·9	51·1	60·6	66·0	64·1	56·2	44·1	32·0	18·6	40·3
Mean daily range,	20·5	22·4	19·2	20·8	23·3	23·1	21·5	20·1	20·6	17·9	16·8	18·3	20·4
Absolute highest,	51·8	50·8	64·7	76·8	91·7	96·5	96·2	94·7	87·7	82·1	63·7	57·7	96·5
Absolute lowest,	-34·5	-30·5	-27·2	-3·6	24·4	32·0	38·0	39·0	24·9	14·8	-15·7	-31·5	-34·5
Per cent. of cloud,	57	53	56	54	58	56	52	55	56	60	62	52	56
Precipitation,	2·43	3·76	4·12	2·59	4·23	3·64	3·79	4·18	3·21	3·93	4·21	3·62	43·71

A very casual inspection of Table IV., showing the normal percentage of bright sunshine in various parts of the Dominion, as registered by Campbell-Stokes recorders, will render it very obvious that Canada is a country of clear skies. There are few, if any, places in England that have a larger normal annual percentage than 36, and there are many as low as 25, whereas in Canada most stations exceed 40, and some few have as high a percentage as 46. In England at but few places does the normal of any summer month exceed 45 per cent. At German stations the August maximum averages under 50 per cent. and in a few cases reaches 52. In the south much higher values are obtained: Vienna 54, Zurich 57, Trieste 66, Lugano 67, Rome 75, Madrid 84. These figures

show that it is only the southern parts of Europe that have more sunshine in the summer months than Canada.

TABLE IV.—Percentage of bright sunshine at fourteen stations in the Dominion (100 being constant sunshine).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Esquimalt, B. C., .	20	22	35	32	40	42	53	56	36	37	20	16	34
Agassiz, B. C., . .	21	21	24	21	29	35	46	48	27	30	18	14	28
Battleford, N. W. T.,	29	45	46	47	55	58	59	52	31	49	26	31	42
Winnipeg, Man., . .	43	48	51	47	53	54	58	59	34	37	35	37	46
Brandon, ,, . .	41	45	47	40	44	46	58	61	47	36	29	32	44
Lindsay, Ont., . .	26	34	44	50	47	56	57	53	53	39	24	21	42
Toronto, ,, . . .	29	34	43	49	48	56	60	58	56	42	28	22	44
Stratford, ,, . . .	25	24	36	40	44	54	59	55	45	37	24	17	38
Windsor, ,, . . .	24	27	39	45	47	55	60	54	48	42	30	20	41
St. Catherine s, Ont.,	17	23	30	40	46	54	56	57	51	33	21	16	37
Montreal, ...	33	41	47	52	51	54	59	59	54	40	29	30	46
Fredericton, . . .	40	44	41	47	46	48	51	50	48	43	33	36	44
Sydney, ...	31	34	32	39	43	47	48	46	49	34	27	19	37

The Great Lakes never freeze over, but usually most of the harbours are closed by ice by about the middle of December, and remain frozen over until the end of March or beginning of April. The average date of the closing of navigation on the St. Lawrence river is December, and of the opening April 21st. Harbours on the Gulf of St. Lawrence are likewise closed by ice during the winter months, but on the Bay of Fundy and the coast of Nova Scotia the sea is open all the year round.

THE PARLOUS PLIGHT OF GEOGRAPHY IN SCOTTISH EDUCATION.

By A. J. Herbertson, F.R.S.E., F.R.S.G.S.

At the Toronto meeting of the British Association a report on the position of geography in the educational system of the United Kingdom was read, from which we learn much about the neglect of that subject in Scotland.

"In the report questions of methods of teaching geography, the importance of good maps and appliances, the need of open-air and museum teaching as well as of frequent excursions, are not discussed, although in the improvement of our methods lies much of the hope for the future." The inquiry is confined to the position geography takes in our educational system as revealed by various regulations and programmes, which are compared with those of some other countries. Selections from these documents are printed as appendices and form the greater part of the report.

Geography is not compulsory in the primary schools of Britain. It may be one of two possible class subjects chosen from a number, and is taught in two-thirds of the schools in England and Wales, and in about ninety-five per cent. of those in Scotland. So there are comparatively few boys and girls in the northern country who do not learn geography at school.

It seems a natural and obvious consequence of this that all teachers in elementary schools should receive a thorough training in geography. Unfortunately, if this conclusion is also drawn by the educational authorities, the British Association Report shows that they make utterly inadequate provision for this necessary training.

It has often been pointed out how the Education Departments, both for England and Scotland, have devised an extraordinary and effective means for the elimination of those fittest to be teachers in geography, by excusing them from doing any geographical work in the Training Colleges.

If the students received thorough geographical training before they entered the Training Colleges, this would be intelligible and partly excusable. But they rarely do; for, unless the teachers who prepare them for the Queen's Scholarship Examination are both geographical enthusiasts and specialists, they cannot, with the best will in the world, such as most of them undoubtedly have, give the necessary time and attention to adequately prepare the future teachers in this subject. But, although we know of some teachers who conscientiously do their best to give pupil-teachers some geographical insight, it would appear to be exceptional, in Scotland at any rate. Mr. King in the *Report on Scottish Training Colleges*, 1896, says:—"But geography is a subject in regard to which the pupil-teachers, as a rule, especially in country schools, do not, I believe, receive any assistance from their instructors. The candidates are expected, with the help of a text-book, an atlas, and their general intelligence, to prepare themselves for this part of the examination."

This, of course, is deplorable, and yields sad results. There is a "want of exactness of knowledge shown . . . by almost all candidates." To show the state of mind of many of them, we may quote Mr. Boyd's report on the entrance papers in geography, 1896:—"A *lagoon* was confounded with, among other things, a *monsoon*, a *crater*, or with a *geyser*, and very frequently a *glacier* with an *avalanche* or an *iceberg*." Mr. King bears this out, and points out that "Steppes have nothing to do with steps or terraces. Glaciers are not formed on the tops of mountains, but in high mountain valleys towards which snow-fields converge. The Gulf Stream does not become heated *almost to boiling point*." But can such a system be expected to yield much better results?

The number of those who really merit distinction is naturally very small, for one inspector tells us that in one set of papers only 33 out of 430 received over eighty per cent. Therefore very few can obtain the special distinction in this examination which excuses them from appearing at geography examinations for their Teacher's Certificate.

Such being the case, we should expect that careful training in geography was an important part of the Training College curriculum. Instead of being one of the subjects most carefully and thoroughly studied

in these Colleges, it is treated by the Scottish authorities in a most contemptuous way, and set aside as of little or no consequence.

True, in England geography is taught in most Training Colleges. But the *Scotsman* asserts that this is because of the low standard of geographical training received by pupil-teachers in England, who do worse in the Queen's Scholarship Examination than Scottish ones—indeed, so badly, that the Royal Geographical Society has withdrawn its special prizes at this examination in England, but not in Scotland. The heads of some of the English Training Colleges, however, believe in the use of geography, and insist on *all* students taking up this subject in College, whether the Education Department would excuse any of them or not.

The British Association Committee was informed that "the pupils in most Scottish Training Colleges, whether they study geography necessarily or voluntarily, do so by themselves. Their work, however, is prescribed by a master who sets an examination paper at intervals, and afterwards criticises the work done by the students in these examinations. In the Scottish Code the subject is called 'Geography and Physiography,' and physiography is regularly taught in the Training Colleges." The Committee very properly adds that "This is obviously inadequate geographical training"—especially if physiography is the elementary physical science called by that name by the Science and Art Department.

But it seems probable that even this physiography is not now taught in some of the Training Colleges, for one of Her Majesty's Inspectors suggests this as the most plausible explanation of the answers given in a recent examination (Report, 1896). From the official report, then, we are forced to conclude that even physiography has ceased to be taught, or else is most inadequately taught, in some Scottish Training Colleges.

Geography, especially the principles of physical geography or physiography, cannot be learned from books alone; and it is a great injustice to our future teachers to set them to study this subject with only a nominal supervision of their reading. Reading, at least of the common type of text-book, which rarely takes any note of recent research, and is seldom scientific, should not play the most important part in geographical training, which must be based on personal observation and experience in the first place, and judicious study of authoritative books and maps in the second. Practical work is quite as essential in geography as in botany or geology, as translation or conversation is in learning a foreign language. Without this practical work much geographical teaching comes to consist of mere words, which may or may not be sonorous, but have little other claim to consideration.

The work done in geography by Normal School students is naturally not of a high standard. From the Inspector's report we learn—"The papers, almost without exception, are neatly executed, but very many are sadly wanting in accuracy of statement. The writers are sometimes evidently guessing, or are trying to conceal want of knowledge under a cloud of words. Maps are, as a rule, neatly drawn, but they are often marred by blunders in topography. This is specially noticeable as

regards the south coast of England, and, indeed, generally less acquaintance is shown with the geography of the home countries than with that of the more distant."

"The answers in physiography are, with comparatively few exceptions, of poor quality. The explanations offered about the variations of the seasons are often also singularly unintelligent. Even when the familiar diagram is correctly reproduced, the accompanying description not seldom shows that the writer has either very erroneous or very dim ideas on the subject."

Such are the opportunities our teachers possess of obtaining a training in geography, and the results. Small wonder that the geographer rubs his eyes to see if this takes place in the actual orderly world which he studies, or in the topsy-turveydom of Gilbertian opera. We have no doubt about the desire of teachers to make the most of the subjects that they have to teach; but if they have had no opportunities for the systematic study of a subject, how can they make it valuable as an educational discipline, or in its applications to the affairs of life? Geography cannot any more than other sciences be profitably taught by pupil-teachers, but only by those thoroughly trained in its methods and principles. At present it is the only natural science subject practically universally taught in schools, and yet, in all Scotland, where can a teacher get a scientific training in this subject? As long as the educational authorities treat it as a subject of no importance, are our teachers likely to give it proper attention in school?

If the educational authorities consider geography a useless subject in schools, let them frankly abolish it. If they consider it a proper subject to be taught, let them see that the teachers are trained in it. But, as we have seen from this British Association Report, they neglect to do this, and permit the Training Colleges practically to set aside the subject.

We might explain this condition of affairs by assuming that the authorities know neither the practical nor the educational value of geography, if for them it still remains a purely verbal study, surviving in schools owing to the force of a tradition which it were well to gradually obliterate by neglect. But it seems hardly conceivable that they are ignorant of the progress of scientific geography during the present century, under the inspiration of Humboldt and Karl Ritter, and especially of its rapid development in the last quarter of a century; that they have not realised the value of geography as a unifier of school studies, as a training in accurate observation and precise description, as a study well fitted to stimulate not only memory, but also intelligence.

Such an apparent indifference to a proper organisation of the training of our teachers in so important a department of their work seems conceivable only on the hypothesis that those in authority are actually not fully alive to the existing state of affairs in the Training Colleges. Yet it is difficult to reconcile this hypothesis with a new and seemingly retrograde step, which appears to be contemplated.

Far from making provisions to keep up with the progress of geography, as the educational directors in other countries strive to

do, or to increase the marks given to it, as the English Educational Department has done, the Scottish Education Department first reduced its value, and now appears to have decided to throw it over altogether, as a subject in which its teachers need not be trained in the Normal Schools.

In the most recent Syllabus of subjects for the Teachers' Certificate Examination for Scotland, we find the following notes appended to the programme in geography for 1897 :—

N.B.—In 1898 STUDENTS *will not be examined in Geography; but* ACTING TEACHERS *who have not previously passed in the subject, either at the Queen's Scholarship Examination or Certificate Examination, will then be required to take it, and, if they do not obtain at least* 40 *per cent. of the maximum of the paper, will be held to have failed in the Examination.*

In 1898 *Geography will be omitted from the list of second year subjects.*

Could the outlook be worse?

Is it not time questions were asked in Parliament by members who know the urgent need for thorough and sound geographical training?

But, perchance, we may be doing a great injustice to my Lords and their advisers. Her Majesty's Inspectors and the Secretary of the Scottish Education Department have all testified in recent reports to the inadequate way in which geography is taught. This new step may be the resulting advance. We hope so, for it would be a sad sight for Scotsmen to see their educational directors the laughing-stock of all educational authorities, as well as the unconscious abettors in a commercial decline, which a widening and intensifying of practical education might do much to avert, or might even change into a new prosperity.

We welcome this new step, if the Scottish Education Department has arranged to substitute thorough teaching and efficient inspection for the present system of neglect and written examinations in Training Colleges. They show their appreciation of geography in choosing it as the first subject in which to make this experiment. Geography is a subject which cannot be properly taught and tested without actual landscapes, maps, globes, models, and photographs, which of course cannot be utilised in an ordinary written examination. Oral and practical are more important than the written examinations in geography, as in biology and many other sciences; and we shall be the first to rejoice if the Scottish Education Department recognises this.

Few would deny that geography has a practical value for pupils in secondary schools, and we should expect to read accounts of a better state of affairs in the section of the British Association Report dealing with them. Confining our attention to Scotland again, we read in the Report the following :—

"In the examinations both of the Education Department and of the Universities geography occupies a subordinate place in the examination in English.

"In the preliminary examinations for the Scottish Universities *two* questions

in geography have to be answered in one of the papers in English for Arts and Science Students, but only *one* question is compulsory for medical students.

"In the Edinburgh University Local Examinations elementary history and geography form one compulsory subject in the preliminary, geography and physical geography two optional subjects in the junior, geography an optional subject in the senior, and commercial history and geography a compulsory subject in the commercial certificate examinations.

"The position of the Scottish Education Department has been clearly defined as follows :—

"'With regard to history and geography, my Lords have little to add to the remarks which they have made in previous years. These subjects enter largely into the curriculum of many schools ; they are required by many of the bodies by whom the leaving certificate is recognised, and *my Lords are unwilling to do anything which would discourage the continuance of such instruction. They endeavour to give a wide option in the questions set, and to afford opportunity to all who have not entirely neglected the subjects to show a knowledge of them in some branch or other.* More than this they have not demanded, and do not propose to demand, as a necessary condition of a pass, but more extensive knowledge will receive *ample* recognition.'—(*Report on the Inspection of Higher Schools and the Examinations for Leaving Certificates*, 1895.)

"'Candidates must answer *one* question, and *a second question may be attempted*, if desired, in the lower grade examination, while *two questions must be answered, and three may be attempted*, in the higher grade examination. *Full marks can be obtained for honours grade certificates without any question in geography being answered.*'—(*Report*, 1895.)[1]

Again the inevitable result is found, as Sir Henry Craik points out :—

"The geography is in general faulty, and there is rarely evidence that this subject is taught in any methodical way, or presented to the pupils in such a manner as to make a vivid impression upon them."

We hope, however, that Sir Henry Craik's great influence will soon alter these conditions, which will prevail until both teachers and pupils have more adequate opportunities of learning geography than they possess at present. There is little use in merely modifying examination papers and writing severe reports. The proper plan is to modify the teachers' opportunities so that they may learn to see and think geographically, and be encouraged to devote more attention to geographical work both in and out of doors, during school hours. We would strongly recommend, especially to those who do not realise the educational value of the subject, and the important part it plays in education abroad, the perusal of the instructions issued to teachers of geography in secondary schools by the French Education Department.

The teachers in secondary schools receive quite as little if not less training in geography than those in elementary schools, unless they attend the classes in geology at the universities, where they must learn some physiography. Perhaps it is not so necessary for every secondary school teacher to have a thorough geographical training as it is for those in elementary schools. But proper training is essential for those

[1] The italics are ours.

who have to teach geography. At present the teacher looks in vain for a Normal School or a University in Scotland where he can get some scientific training in geography. The Scottish Universities have not yet followed the example of the English Universities and University Colleges in supplying this, but we hope it is merely due to the reorganisation caused by the introduction of the new regulations. Now that these are in working order, the next development should be provision of adequate training for secondary school teachers. For this, properly equipped geographical departments must be organised. Such departments are necessary in the university nowadays, not merely for geographers and teachers of geography, but also for students of history and of economics, as well as of geology and biology. Geographical departments are found in the first-class, and even in most of the second-class, universities on the Continent, and it is to be hoped that before long the Scottish Universities will also have them. Professor Davis' able article on this subject in the January number should be consulted.

In the April number of *Petermanns Mitteilungen*, there is a list of classes held and lectures delivered at the universities and technical schools in the German Empire, and the German parts of Austria and Switzerland, on geography and allied subjects during the summer session of 1897. From this list it appears that 85 professors in the German Empire, 20 in Austria, and 9 in Switzerland are engaged in such work, and if we omit the courses in geology and meteorology, and general courses in statistics, anthropology, and ethnology, we find 51 professors in the German Empire, 11 in Austria, and 5 in Switzerland, giving courses in subjects that may be held as belonging more strictly to the domain of geography, the number of courses being 98, 17, and 16 respectively.

In the *Geographisches Jahrbuch* for 1896, the following are the numbers of geographical chairs and lectureships in the universities and colleges of the chief countries:—France, 41; German Empire, 35; Austria, 16; Italy, 16; Russia, 15; Belgium, 7; Switzerland, 7; United Kingdom, 5. The lecturers in the English University Colleges should perhaps be added to the number for the United Kingdom, which would then be raised. But it is better to deduct every teacher in the foreign institutions who has more than geography within his province, whether it be meteorology or ethnography, geology or history; then the figures are: for the German Empire, 31; France, 28; Austria, 16; Italy, 11; the United Kingdom, 5 (in the Scottish Universities, 0). These figures do not include geographers such as Professors de Lapparent and Levasseur in France, Oberhummer in Germany, Boyd Dawkins and Lapworth in England, whose chairs combine geography with other subjects.

The British Association Committee rightly urges that our universities should place geography on the same footing as in Continental universities:—

"In our universities geography should have its due place, equivalent to that of any other university subject now fully recognised. For degree examinations

it should be an optional subject, both in arts and science. It should be compulsory for some students in a minor standard, for instance, for students reading for honours in history, or anthropology and ethnology, or economics or geology. Teachers of geography in the lower classes of secondary schools should have passed in geography in this lower standard, while those responsible for the teaching of geography in the highest classes should have taken honours in geography. The universities should therefore provide the skilled teaching and efficient equipment that are necessary for a subject regarded as of first-rate importance by nearly every first-class university outside the English-speaking lands.

"In all technical, commercial, and professional schools, general as well as applied geography should have a more prominent place in the curriculum than it occupies at present, both from an educational and utilitarian point of view."

The need of graduates trained in geography was never greater than at present. The general principles and facts of geography are best learned at school. But geography in its technical phases, more particularly commercial geography, should be taught in our commercial and technical colleges, as is systematically done in Germany, France, and other rival countries. Highly trained teachers are necessary for this, unless commercial geography is to be confined to the catalogues of commodities and tables of statistics that are so often mistaken for it at present. It is quite impossible to exaggerate the importance of a sound training in economic geography, such as certainly cannot be had anywhere in Scotland at the present day. As far as we know, outside the evening schools of some School Boards, there is only one class in commercial geography in Scotland, and that a junior one. Thus even the practical value of geography is lost sight of owing to the general apathy to the subject common throughout our educational system.

OBITUARY: 1897.

By J. W. M'Crindle, M.A., M.R.A.S.

Vivien de Saint-Martin.—On the 28th of December 1896 this illustrious French geographer died at Versailles, in the ninety-fifth year of his age. He was born in 1802 at Saint-Martin de Fontenay in the Department of Calvados, and having at an early age proceeded thence to Paris, he there embarked on a literary career. He was drawn at once to the study of geography, and all the rest of his long life he devoted himself, if not quite exclusively, yet with unwearied assiduity, to the investigation and exploration of the facts of that science. In 1821 he was instrumental, along with others, in founding the Geographical Society of Paris, and, as we learn, was for many years the sole survivor of the group of his associates in that undertaking.

The amount of work which Saint-Martin accomplished in his chosen field of research was truly enormous. He had no passion but for learning, and this absorbed all the energies of his nature. He passed his life in reading, pen in hand, and taking notes for the composition of his works. In these, it may be remarked, questions of physical geo-

graphy held a place second to those which belonged to the historical and critical side of the science. Among the numerous productions of his pen may be mentioned a *Universal Atlas* (published early in his career, in 1825), and works on *Asia Minor*, on the *North of Africa in Greek and Roman Antiquity*, on the *Greek and Latin Geography of India, and in particular on the India of Ptolemy in its Relations with Sanscrit Geography*, and on the *History of Geography and of Geographical Discoveries*, this last being the best known of all his works.

About the year 1860 he conceived the plan of a gigantic undertaking—*A Dictionary and an Atlas of Universal Geography*. He made a beginning with both works, but his advanced age, and the rapidity with which geographical discoveries succeeded each other, forced him to employ younger men as his coadjutors, and the work, which was finally taken up by M. Rousselet, was brought to its completion the year before its originator died. It must be mentioned also that for twelve years (from 1863-75) M. de Saint-Martin was the sole author of the annual record of the progress of geography in the publication (now extinct) called the *Année Géographique*. About the year 1870 he ceased to attend the meetings of the Geographical Society, and in the seclusion of his library at Versailles found his pleasure in studying works of erudition, those especially of antique times. He is described by a writer in *Le Tour du Monde*, who saw him in his late years, as "an amiable old man, abundant and sprightly in his talk, and astonishingly fresh. Age had not impaired his powers, and for years he appeared to us at each visit to be renewing his youth." Among works other than geographical which he published were a *History of the Revolution* and a *History of Napoleon I.*; nor must we omit to mention also a translation of the complete works of Sir Walter Scott.

Admiral Sir George Richards, K.C.B., F.R.S.—Admiral Richards, who signalised himself by carrying out a long series of maritime explorations, and by rendering other services of great benefit to his profession, died on the 14th of November 1896. He was the son of a captain in the Royal Navy, and was born in the year 1820. He entered the navy at the age of twelve, and after having been for two years in the West Indies, served for five years as a midshipman in the expedition which, first under the command of Admiral Beechey, and afterwards of Sir E. Belcher, made surveys among the islands of the Pacific and along the western shores of North America. In 1840 he took part in the operations of the war with China, and two years later, when promoted to the rank of lieutenant, was employed under Admiral Sulivan, first in surveying the Falkland Islands, and then in the naval operations carried on in the Parana and Uruguay rivers in 1845 and 1846, in the latter of which years he became a commander. He served next under Admiral Stokes on the survey of the coasts of New Zealand, and on his return to England in 1852 was appointed to the *Assistance*, one of the four vessels which were despatched on the Franklin search expedition. This vessel, which was commanded by Belcher, wintered in Northumberland Sound, and here Commander Richards, travelling by sledge, explored the channels

in that locality. In his expeditions over the ice he covered no fewer than 2000 miles. On his return to England after these important services he was promoted, in 1854, to the rank of captain. Two years later we find him again in the Pacific carrying out surveys of Vancouver Island and of the coasts in its neighbourhood. On his voyage homeward, which was taken in 1863, by Australia and Torres Straits, he made surveys of these parts by the way. On his return he was appointed Hydrographer to the Admiralty, and in 1870 he attained the rank of rear-admiral, in 1877 that of vice-admiral, and in 1884 that of admiral. He was made C.B. in 1871, and seventeen years later K.C.B. After his retirement from the service he interested himself in the promotion of telegraphic enterprise.

Sir Rutherford Alcock, K.C.B., D.C.L.—Sir Rutherford Alcock, who had made for himself a great name both as a diplomatist and as an Oriental scholar and geographer, died in London on the 2nd of November last at the advanced age of eighty-eight. He was born in that city in 1809, and having there studied medicine in King's College, he served as an army doctor in the British auxiliary forces which were employed in Spain and Portugal during the troubles which convulsed these countries in 1833 and the year following. Ten years later he proceeded to the East on receiving the appointment of consul at Fu-chau, a place which had not long before been thrown open to foreign commerce. Two years afterwards he was promoted to the consulship at Shanghai, where he remained for eight years. During his tenure of this office disturbances, excited by the Taeping rebellion, broke out at Shanghai; but the insurgents, though successful in capturing the native part of the town, did not venture to attack the foreign quarter in face of the preparations which the consul had organised for its defence. In 1854 he was transferred to Canton, where the quarrel between Sir John Bowring and the Chinese officials about the opening of the port to foreigners had already broken out. Before this quarrel, however, had its upshot in war, the consul had taken his departure home on leave of absence.

Mr. Alcock again left England for the East to serve in Japan as the first British minister to that country, Lord Elgin having in 1858 made with it a treaty which secured the admission into it of foreigners. As the Japanese were in general violently opposed to this innovation, the minister's position here was one of extreme difficulty. He was resolute, however, in maintaining the rights which the treaty had secured for his countrymen, and he never suffered any wrong or outrage done them to go unredressed or unpunished. His firmness was at the same time tempered with tact and judgment, and so high an opinion came to be formed of the merits of his administration that he was made, in 1862, a K.C.B. His energies were not, by any means, all absorbed in diplomacy. He furthered the interests of geography by travelling in various directions into the interior parts of Japan, which, up to his time, were all but totally unknown. He was observant, also, of the manners and customs and arts of the natives, and studied

their language and literature. To the *Journal* of the Royal Geographical Society he contributed papers, in which he recorded the results of his explorations, and described such subjects of interest as fell under his observation in the course of his travels. In 1863 he published his famous work, entitled *The Capital of the Tycoon*, and five years later another work in which he gave an account of the *Art and Art Industries of Japan*. He wrote also a book on the *Elements of Japanese Grammar*, and another which contained familiar *Dialogues in Japanese*, accompanied with translations both in French and English. In 1865 Sir Rutherford went back to China in the capacity of British minister at Peking, and in 1871 he retired from service on pension. In 1876 he was elected President of the Royal Geographical Society, an office which he held for two years.

J. Theodore Bent.—Mr. Theodore Bent, so widely known for his geographical and archæological discoveries, was cut off in the prime of life on the 5th of May last after his return to London from an expedition which, in company with his accomplished and devoted wife, he had made from Aden into a part of the interior of Arabia not previously explored. His death was caused by an attack of pneumonia supervening on a malarious fever which he had contracted in the course of that expedition. He was born near Leeds in 1852, and was educated at Malvern Wells, Repton School, and Oxford University. After his marriage, which took place in 1877, he made annual excursions with his wife, who was a daughter of the late Mr. Hall Dare, D.L., to out-of-the-way places where there was a likelihood of ruined sites being discovered. His attention seems to have first been directed to Italian history as a subject for his pen, and having visited San Marino he wrote a small volume on that little Republic. He travelled next in Greece and Asia Minor, and published the results of his observations and excavations in a pleasantly written volume called *The Cyclades; or, Life among the Insular Greeks*. Having afterwards visited the Bahrein Islands, he made them the subject of a paper which appeared in the *Journal* of the Royal Geographical Society. His best-known piece of work is perhaps his investigation of the Zimbabwe ruins in Mashonaland, which he and his wife visited in 1891. He examined next the monuments of antiquity which exist at Axum, the capital in old days of Abyssinia. In one of the three expeditions which he undertook into Arabia, he explored the beautiful valley of Hadramaut, which, at some distance, runs parallel with the southern coast of Arabia. In the course of last winter he did some considerable exploring work in the island of Socotra, which lies in the Indian Ocean off the coast of Arabia and is but little known. The writer of a notice of Mr. Bent's death in the *Athenæum* concludes it in these words:—"His friends will long lament one so kind, genial, and unassuming, who never sought for selfish advantage, and was always eager to profit by the knowledge of those more learned than himself." Not a few members of our Society will remember the favourable impression he made when he lectured before them in 1895

on Southern Arabia. It need hardly be said that as his journeys were generally made to regions unvisited and inhospitable, they were attended with hardships more or less severe, and were sometimes even made at the peril of his life.

NEY ELIAS, C.I.E.—This distinguished traveller and geographer, who made extensive explorations in China, Mongolia, the Pamirs, Sikkim, Burmah, and elsewhere, died in London on the 31st May last. He was born in Kent in 1844, and educated partly in France and in Germany. Destined for a commercial life, he went to the East in 1866 to serve a firm engaged in the China and Japan trade. Before leaving England, his love of geography had led him to take lessons in astronomy and surveying, and he was thus able, when he afterwards travelled, to determine positions by astronomical observations, and to make surveys for the proper mapping, as occasion served, of the countries through which he passed. After he had been three years in China, he wrote for the Royal Geographical Society a paper on the diversion of the Hoang-Ho or Yellow river into a new channel between the years 1851 and 1853. This paper and the chart with it, which embodied the results of three journeys made on separate occasions, received a warm tribute of praise from Sir R. Murchison, who was at that time the President of the Society. In 1872 he started on the memorable expedition which he made across Western Mongolia, from the Wall of China to the Russian frontier, and from thence to Nijni-Novgorod, a distance in all of about 4800 miles. Through all this route he carried on a continuous series of observations, and he was rewarded by being presented with the Royal Geographical Society's *Founders' Gold Medal*. Early in 1874 Mr. Elias, on the recommendation of Sir H. Rawlinson and Sir Bartle Frere, was appointed an extra *attaché* in the Foreign Office at Calcutta, and in September of the same year Assistant to the Resident at Mandalay in Upper Burmah. Not long afterwards he was instructed to join the British Overland Mission to China as second in command to its leader, Colonel H. Browne. The mission, it is well known, was repulsed after it had advanced only a few marches beyond the border, and was altogether a disastrous failure. No blame, however, could be attached to Mr. Elias, who discharged with consummate ability all the duties which devolved upon him, and gave good advice which was not taken. His next sphere of service was in Ladak, which he reached by the end of 1877. Here, as there was little to be done besides ibex shooting, he prosecuted his researches into the history of Central Asia. Two years afterwards, however, the Indian Government, desirous of establishing good relations with the Chinese, who had re-occupied Kashgar after the death of Yakub Beg, sent Mr. Elias into Eastern Turkestan on one mission after another—now to Kashgar and now to Yarkand—so that he had several times to cross and recross the Karakorum. In 1885 he left the latter city to explore the Pamirs, where he fixed positions and altitudes, and settled also the long-disputed question of the true sources of the Oxus. Having reached the camp of the British Boundary Commission near Herat, he returned thence to India by way of Balkh and Chitral.

Mr. Elias was next employed as head of a Commission for settling the political geography of the Shan States, which lay between Burmah and Siam, and when this work had been completed he was attached to the Sikkim expedition. Towards the end of 1891 he was appointed to Meshed as consul-general for Khorasan and Seistan, and held this post till late in 1896, when his broken health obliged him to take furlough and return to England. Here he spent his leisure in preparing works on the history of the Moguls. His death, which was sudden, was the result of blood-poisoning. Mr. Elias was a man of fine character and attractive qualities, though of a somewhat reserved demeanour. His friend, Mr. S. Wheeler, thus concludes an able notice of his life and work:—"The splendid proofs of his courage and endurance, his keen judgments and wide attainments, are marked for geographers on the map of Asia."

Admiral Sir Alexander Milne.—We record with great regret that this distinguished Admiral, who was one of the Vice-Presidents of our Society, died at the end of December 1896 from the effects of a chill which brought on an attack of pneumonia. He was born in 1806, and was the second son of Admiral Sir David Milne. He entered the naval service, and after a period of service at foreign stations attained the rank of commander in 1830. Some years afterwards he was engaged in the suppression of the slave-trade in the West Indies, and then in protecting the fisheries of Newfoundland and Labrador. He became captain in 1839 and was a Junior Lord of the Admiralty from 1847 to 1859. In the year following he was appointed commander-in-chief on the North American Station, and in the course of this service succeeded by his tact in maintaining good relations between this country and the States. He became some years subsequently commander-in-chief of the Mediterranean and Channel squadrons. After his retirement from the service he employed himself usefully in committee work for a variety of schemes, such as the defence of the colonies and the organising of the Naval Exhibition.

Ernest Giles.—Born in Bristol, Mr. Giles migrated in his childhood to Australia, where his family settled in Melbourne. At that time the exploration of the interior of the island continent was being vigorously carried on by several well-known men, and no doubt the narratives he heard of the expeditions then in progress stimulated Giles, who had a natural taste for bush life, to emulate their exploits. Between 1872 and 1883 Giles made six important journeys in South and West Australia. Twice he crossed the western part of the continent, by routes running to the north and south of Forrest's course in 1870. To him we owe the discovery of Lake Amadeus, Queen Victoria Springs, and many other features that are now familiar to the geographer. The cost of most of these expeditions was borne by Sir Thomas Elder.

The results of his exploration Mr. Giles made known by several works, the best known being, probably, *Australia twice traversed*, published in

1889. The Royal Geographical Society conferred on him its Gold Medal as a recognition of his signal services to geographic research.

Mr. Giles died at Coolgardie, last October, at the age of fifty-eight.

THOMAS BRUMBY JOHNSTON.—Mr. Johnston, who died on September 9th, in his eighty-fourth year, was head of the firm of W. and A. K. Johnston. He was author of the *Historical Geography of the Clans of Scotland*, and edited several editions of the *Royal Atlas*, first compiled by his brother, Dr. Alex. Keith Johnston. Mr. Johnston was a member of the Royal Scottish Geographical Society from its foundation, and had served on its council. The appointment of geographer to the Queen, which he held since 1877, has been conferred on his son, Mr. G. Harvey Johnston.

JOHN LOWE NICOLL.—More than fifteen years ago Mr. Nicoll went out to Nyasaland in connection with the Blantyre mission. He afterwards entered the employment of the African Lakes Company, and during this period fought in the war against the Arabs of north Nyasa. In 1889-90, as assistant to Sir Harry Johnston, he founded the Abercorn station on Lake Tanganika, and extended our knowledge of the fauna and flora of the country by making collections. Latterly he had been in the service of the British Central Africa Protectorate, and at the time of his death, in February last, he was vice-consul in South Nyasaland. He became a member of this Society in 1891.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

MEETING OF COUNCIL.

AT a meeting held on Jan. 19th, the following lady and gentlemen were elected members of the Society :—

Mack, Miss J. T.
Darling, Alex.
Davidson, Prof. W. L., LL.D.
Grieve, Robt.
Jackson, Chas.
Masterton, Jas.
Methven, J. Cox.
Robertson, D. C.
Thomson, Major W. Anstruther.

LECTURES DELIVERED IN JANUARY.

On Friday, Jan. 14th, Mr. A. J. M'Millan lectured in Edinburgh on British Columbia and Yukon. Sir Thomas Clark, Bart., presided.

Mr. M'Millan addressed the Glasgow Branch on the evening of the 13th, Mr. W. F. G. Anderson presiding at the meeting.

Owing to his literary occupations, Mr. Jackson, of the Jackson-Harmsworth Expedition, was unable to address the Society last month, as had been arranged.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Sea of Marmora.—In the *Zapiski* of the Russian Geographical Society, tom. xxxiii. No. 2, a full report is published of the Russian researches, briefly reviewed in vol. xi. p. 528. The hydrographic work is discussed by M. I. Spindler, and a *résumé* in French is added. The bottom consists of three hollows, two of which lie in the western part of the sea and are separated from one another by a submarine ridge, 300 to 400 fathoms deep, running from Eregli to the Isle of Marmora. The greatest depths given on Admiral Wharton's chart are from 600 to 650 fathoms, while Spindler's deepest soundings are from 630 to 688 fathoms, and the isobaths take a different form. The eastern hollow, lying south-west from Princes' islands, has, according to Wharton's chart, depths of 660 fathoms at most, whereas Spindler's maximum is 767. By calculations of areas and volumes the mean depth of the whole sea is found to be 158 fathoms. The mean surface temperature during the period of the observations (in September and October), was 67° F., the air temperature being 66·1°. Both attain their maximum at about 3 P.M.; the minimum water temperature occurs about 3 o'clock in the morning, and that of the air about two hours later. It would seem that the water is about half a degree colder at Gallipoli than at the Bosporus.

The salinity is less near the Bosporus, doubtless owing to the current coming from the Black Sea. This current diverges from the strait in two directions, one part following the northern coast of the sea towards Eregli and Rodosto, while the other makes a straight course for the island Kalelimni and sends a branch towards the Gulf of Ismid. The centre of the sea and the gulfs of Gallipoli, Ismid, and Artaki have a maximum salinity of 2·5 per cent. The temperature down to 6 fathoms is that of the surface; between 8 and 10 fathoms it sinks 0·9° to 1·1° per fathom; and from 100 fathoms it remains constant at 57·6° down to the bottom. In the south-eastern part of the sea, however, the constant temperature is not reached till 120 fathoms. The salinity increases down to 100 fathoms, very slowly down to 6 fathoms, and then on an average 0·14 per cent. for each fathom down to 14, after which the increase is extremely slow and scarcely perceptible below 100 fathoms. Accordingly there are four layers as regards temperature and salinity:—(1) From the surface to a depth of 6 fathoms, with an average salinity of 1·0188 ($S\ \frac{17·5}{17·5}$ C.) and a mean temperature of 67·3° F.; (2) From 6 to 14 fathoms, with a mean salinity of 1·01238 and a mean temperature of 64·9°; (3) From 14 to 120 or 200 fathoms, with a mean salinity of 1·0291 and temperature of 59·5°; lastly (4) A layer of almost uniform salinity (1·0293) and a constant temperature of 57·6°.

The zones of salinity remain on the whole constant, and must be therefore due to some constant cause. This is probably the double current in the sea of Marmora, the water from the Black Sea, where the specific weight at the surface is 1·0138, flowing over that which enters from the Archipelago, which has a specific gravity of 1·0296. The waters become to some extent mixed within the straits so that the one layer becomes a little salter and the other sweeter. A slight modification is also caused by the variation of temperature during the course of the year. In the sea itself the conditions are much the same, and hence there is a certain gradation in the vertical distribution of the salinity. Where the lower current

predominates there is an augmentation of salinity, and as the limit of this current varies considerably in different places, there is a zone where the change of salinity is greatest (No. 2). The zone of constant salinity and temperature has a salinity very near to that of the Mediterranean, and is evidently filled with water from that sea. The maximum observed at the bottom in the Dardanelles was 3·89 per cent. The surface salinity increases southwards and westwards from the Bosporus, where it is at a minimum, reaching a maximum in the southern part of the Bay of Gallipoli.

The mean velocity of the surface current may be fixed at 1½ knots, with a mean maximum of 2·8 knots during fresh winds from the north-east. At the entrance of the Dardanelles the lower current has a velocity of 0·1 knot, that of the surface current being 2½. In the Bosporus the surface current, as appears from the observations of Wharton, Makarof, and Magnagni, is very variable, while the under current is relatively stable. Indeed, under the influence of strong south-west winds, the surface current at the entrance has been observed to make for the Bosporus instead of towards the sea of Marmora. The principal cause of the surface current is the rise of level in the Black Sea, caused by the water poured into it from the rivers. This excess of water is carried by the prevailing winds to the Bosporus, where also the winds are favourable to the maintenance and augmentation of the current. In the sea of Marmora the increased pressure gives rise to a contrary current in the direction of the Bosporus, which would increase with the depth were not the velocity diminished by the greater friction towards the bottom. As the surface current carries fresh water out of the Black Sea, and the under current salter water into it, it is evident that the Black Sea must become more and more saline ; but should it attain the salinity of the sea of Marmora, the influx of water from the rivers must still maintain a current through the Bosporus.

ASIA.

The Survey of India.—During the year 1895-96, 63,653 square miles were surveyed on various scales, of which 30,279 were reconnaissance only. Principal triangulation was executed in Burma and Baluchistan. In the former the series which is to connect the Mandalay meridional series with the Assam triangulation was continued ; but the connection was not completed, as expected, owing to the hazy state of the atmosphere and the very difficult nature of the country. In Baluchistan a main longitudinal series, starting from the great Indus series, is to be pushed westwards, in the first instance to furnish an accurate basis for the mass of secondary triangulation that has from time to time been executed in Baluchistan and Makran, though ultimately it may form a link in a series connecting the systems of Europe and Asia. This triangulation, in lat. 26°, starting from the Indus series on the meridian of 67° 15′, has been extended fifty miles westwards into Las Beyla territory, comprising three figures covering an area of 1146 square miles.

Of topographical surveys 19,798 square miles were executed on various scales, in the Southern Maratha country, Sind, Baluchistan, the Himalayas, and Upper Burma. 5079 square miles of new country were geographically surveyed in Upper Burma, and 30,279 square miles on the eastern and western frontiers. Besides the above, a considerable amount of work was done in forest, cadastral and traverse surveys.

One important work was the delimitation by Mr. G. P. Tate of the Baluch-Afghan boundary, from the southern limit of Waziristan to the eastern confines of

the Persian Empire. Of this long line, only the section as far south as the British frontier outpost of Chaman had been settled, when the operations were brought to a close in June 1895. During the year 1895-96 the delimitation was continued to the Koh-i-Malik Siah, a hill which was years ago recognised as the meeting-point of the Persian, Afghan, and Baluch territories. Though it had in consequence obtained a widespread celebrity, the hill had never been properly identified, nor had its position been laid down with any degree of exactness.—*General Report of the Operations of the Survey of India Department*, 1895-96.

AFRICA.

The Rainfall of Cape Colony.—Dr. Buchan's *Discussion of the Rainfall of South Africa during the Ten Years* 1885-94 has been sent us by Dr. Thomas Muir, Acting Chairman of the Meteorological Commission. It is illustrated by sixteen maps, from one of which, showing the annual distribution of the rainfall, it may be seen that, to the north of the latitude of Clanwilliam, the amount steadily increases from west to east, falling short of five inches a year on the Atlantic coast, whereas on the east coast it exceeds forty inches for some distance north and south of Durban. North of the Olifants river, for a great distance northwards, and to a considerable distance inland, the climate is one of the driest in the world. The extraordinary aridity of this extensive region is caused by a great prevalence of south-easterly winds, which become hotter and drier as they advance northwards. Over the high lands (upwards of 3000 feet) to the west of Great Bushman Land the rainfall rises to nearly ten inches, but over the low plains to the east it falls to five inches and under. Farther east it rises considerably, up to forty inches, and a narrow strip of the east coast north of the Umtata river receives more than forty inches.

Very different is the distribution of rain over the southern parts of South Africa, or over the southern highlands lying to the south of the Orange river basin. From Philadelphia, a little north of Cape Town, all along the southern and eastern coasts, and for some distance inland, except between Cape Agulhas and Mossel Bay, the rainfall everywhere exceeds twenty inches. In some restricted localities, as at Cape Town and to the north-west of East London, the rainfall is two or three times as much, owing to the physical features of the country.

Taking January as a typical summer month, we find that atmospheric pressure diminishes from the coast inland, and therefore the winds at this season blow from the sea, being on the whole north-easterly and easterly from Durban to East London, and south-easterly over the western division of the country; but at Cape Town the prevailing direction is south-south-west.

A powerful determining factor in the climates of South Africa is the fact that none of these oceanic winds has traversed any very large extent of ocean before reaching the land. Thus, to the south of 40° S. lat., the prevailing winds are north-westerly, that is, from the land. Again, to the west of South Africa lies one of the most marked permanent anticyclones of the globe, whence proceed the winds that prevail over the adjacent Cape Town and the regions to the northward. Off the east coast of Africa, also, lies an anticyclone where originate the winds that reach the coast between Durban and Port Elizabeth.

On the other hand, in winter barometrical pressure is highest in the interior and diminishes on all sides towards the coast. Therefore the prevailing winds at this season blow outwards, and the rain is consequently much reduced, especially over the eastern half of the colonies. Changes have occurred in the position of the anticyclone west of Cape Town, and an eighteen years' average shows a great

preponderance of southerly and westerly winds, which, as may be seen from the climatological data in the *Challenger Report*, traverse no inconsiderable tract of the South Atlantic, and therefore are moister than the winds on other parts of the coast at this season.

A table shows the difference of each year's rainfall at Cape Town from the fifty-four years' average of 25·82 inches. It reveals sudden transitions in amount from year to year. The means of the eleven-year sun-spot period have been "bloxamed," the average for three consecutive years being taken as the mean for the middle year. The smoothed curve thus obtained is remarkable. The rainfall is above the average in the fifth, sixth, seventh, and eighth years of the period, and below in the other years. The curve further shows two maxima and two minima. The smaller maximum in the first year is succeeded by the smaller minimum in the third year; then comes the principal maximum in the sixth year and, finally, the principal minimum in the tenth year. The difference between the rainfall of the driest and wettest years in the sun-spot period amounts to 4·47 inches. The rise and fall is remarkably steady, but the extreme irregularity of the annual amounts from year to year precludes any hope that the cycle may be of use in forecasting dry and wet years.

MISCELLANEOUS.

Bulletin D of the U.S. Weather Bureau consists of an exhaustive account of the **rainfall of the United States**, written by Mr. Alfred J. Henry.

The success obtained in ostrich farming in South Africa has induced Australasians to experiment on the keeping of emus. In Tasmania a company has been formed for the purpose.—*Aus Allen Weltteilen*, Heft 2, 1897.

The Vienna Academy of Sciences has named the remarkable hollow to the east of Rhodes, discovered by the *Pola* in 1892, the **Sterneck Deep**, in memory of the late Admiral Baron von Sterneck. It is the deepest spot in the Mediterranean east of Crete (see vol. ix. p. 376).

Crater Lake, Oregon, of which an account was given in the *National Geographic Magazine* (see *S.G.M.*, vol. xiii. p. 265), is more fully described in *Mazama*, a periodical devoted to mountaineering in the north-west. A large number of good photographs and maps, etc., add to the value of the number.

Steam navigation on the **Amu Daria**, which has hitherto been maintained from Charjui, where the river is crossed by the Transcaspian railway, up to Patta Hissar, a distance of some 250 miles, will this spring be extended along the Amu and its tributary, the Panj, as far as Faizabad Kala in lat. 69° E. (on the meridian of Kunduz), some 125 miles farther.—*Globus*, Bd. lxxiii. No. 1.

Temperature observations taken in Norway during the **Eclipse of the Sun**, August 9th, 1896, have been published by Prof. H. Mohn in the *Festskrift* of the Christiania University on the occasion of King Oscar's Jubilee in 1897. A reprint has been sent by the author to the Society. The fall of temperature during the eclipse was on an average 3·6° F., being, naturally, greater where the sun was shining brightly before the eclipse.

On Dec. 4th **Dr. Eugen Zintgraff**, the well-known explorer of the *Hinterland* of Cameroons and founder of the Baliburg station, died at Tenerife. In the spring of 1896 he set out with Dr. Esser and Viktor Hösch on another expedition into

the interior, whence he had to return last November owing to illness. He sailed for Tenerife, where he died of malarial fever. Dr. Zintgraff was a comparatively young man, having been born in 1858.

The Canadian Department of the Interior has, during the past two years, been considering the subject of irrigation in the west. The country in the Territories is by no means barren, for it produces a good crop of grass, and water only is required to render it fit for agriculture. From the surveys carried out up to the present, it appears that water sufficient to irrigate 6,325,450 acres is available.—*The Canadian Gazette*, December 16.

It may be well to note for the convenience of our readers who are interested in oceanography and zoology, that the treatise of Mr. Leonard Stejneger on the **Commander Islands**, briefly referred to in vol. xiii. p. 208, is published in the *Bulletin of the U.S. Fish Commission*, vol. xvi. Mr. Stejneger has collected information from many different sources, which he has combined with his own observations. The hydrography of the western part of Bering sea, the meteorology of the islands, and their fauna and flora and their history, are all discussed. Naturally a large part of the work deals with the seal-fisheries, and is of especial interest at the present time.

In the *Quarterly Journal* of the Royal Meteorological Society Mr. R. C. Mossman publishes an article on the Non-Instrumental **Meteorology of London** from 1713 to 1896. It is a digest of registers preserved in the libraries of the Royal and Scottish Meteorological Societies, in the *London Magazine*, the *Gentleman's Magazine*, and elsewhere. The article shows the great increase of fog during recent years, and the records of snow prove that the belief in "old-fashioned" winters is a popular delusion, the average number of days on which snow fell being greater for 1881-1890 than for any previous decade. 1862-1863 was remarkable as being an absolutely snowless winter.

The Commission for Geographical and Geological Researches in **Greenland** has received 150,000 kroner from the Karlsbergstiftung, which are to be devoted to the exploration of the east coast from Angmagsalik to Scoresby Sound. A party will be carried from Denmark in the autumn by a trading vessel to Angmagsalik, and will travel northward as far as it can reach before the vessel returns in the following year. On its report will depend the plan for the main expedition which in the summer of 1900 will be landed at Scoresby Sound, and having passed the winter there, will make its way southwards. Lieutenant Amdrup of the Danish Navy is the appointed leader.—*Globus*, Bd. lxxii. No. 22.

A report on the *Recent Determination of the Longitude of Madras*, by Capt. S. C. Burrard, R.E., has just been issued. The circumstances which induced the Indian Survey to undertake this work were stated in vol. xi. p. 642. The result is that the **longitude of Madras** has been determined to be 5h. 20m. 59·113s., and that consequently the error in the longitude adopted for the triangulation of the Great Trigonometrical Survey of India is +2′ 27·54″. The observations were made with the greatest care possible under the circumstances, but some small errors were unavoidable, and the distribution of these will be a matter requiring much consideration. At Teheran Captain Lenox-Conyngham was able to connect his work at four points with the Russian work executed by General Stebnitzki.

The Special Commission appointed by the United States Congress to inquire into the facilities for the construction of a canal connecting the **great lakes with**

the ocean, have considered the three following projects:—(1) a canal round the Niagara falls to the St. Lawrence; (2) from the St. Lawrence and Lake Champlain to the Hudson river; (3) along the Mohawk valley. Of (2) and (3) the latter route has been chosen. A canal between North Tonawanda and Wilson will connect lakes Erie and Ontario. From Oswego another canal will be constructed to Lake Oneida, and thence to the Mohawk, by which the Hudson may be reached. The length of the canal will be 181 miles, and eighteen locks will be necessary in consequence of the difference of level, 515 feet, between Lake Ontario and the Hudson. The cost is estimated at £16,400,000.—*Revue Scientifique*, December 25.

With regard to the recent boring at Funafuti, reported in vol. xiii. p. 662, which has been assumed in several journals to have yielded results favourable to Darwin's hypothesis of the formation of coral islands, Dr. Murray, in a lecture to the Edinburgh Geological Society on November 19th, expressed his opinion that it confirmed his own theory. All who are interested in the question are aware that Dr. Murray has explained the fact that deep water is often found beside coral reefs by supposing that blocks of extinct coral fall down and form a talus on which living coral can grow within the limit of depth necessary to its existence. Through such a talus the boring at Funafuti was, in Dr. Murray's opinion, sunk. It is admitted that the atoll has recently been elevated about four feet, and that the reefs are extending seawards. Dr. Murray exhibited a photograph of an upraised reef in the Solomon Islands, where large masses of *Meandrina*, partially or completely overturned, are imbedded in a cliff in a position that must have been some hundreds of feet below sea-level at the time when the reef was being formed.

Captain Otto Severdrup had intended to explore the Arctic Ocean between Franz Josef Land and Spitzbergen, but as a Swedish expedition is about to sail for that part of the Polar Sea, he has determined to supplement the discoveries of Nansen by an expedition to the north of Greenland, taking the *Fram*, which has been lent to him for the purpose, as far north up Smith's Sound as possible, and then seeking by sledge expeditions to acquire fresh information about the northern parts of Greenland. Professor Mohn and Fridtjof Nansen, as reported in the *Aarbog* of the Norwegian Geographical Society, declare that investigations on this side of the Polar basin are exceedingly desirable in the interests of science. The problems which they particularly specify as awaiting solution are:—the extension of Greenland towards the north, and the form of its most northern part—whether it be, as Peary believes, an island or group of islands; the situation and character of the still unknown north-east coast; the topography and geology of the islands, if such be found; hydrography—depths, temperature salinity, etc., the formation of the ice on land and sea, in particular of the palæocrystic ice which is so different from that in which the *Fram* drifted; magnetism, aurora, meteorology, etc.

On July 13th the Storthing voted 20,000 kroner to make alterations in the *Fram*, which will give more room for scientific work and render the vessel more seaworthy.

Geographical Association.

The Annual Meeting was held in the hall of the Society of Arts, London, on December 23rd, Mr. Douglas W. Freshfield, President, in the Chair. The *Annual Report* drew attention to the important step taken by the Victoria University in making Geography a University subject by including it in the Preliminary examination in place of Physiography. Reference was made to the appearance of Dr.

H. R. Mill's most useful book, *Hints to Teachers and Students on the Choice of Geographical Books*, a work undertaken at the special request of the Committee.

Applications for a *Syllabus* of Geographical teaching having been from time to time received, the Committee had after much consideration decided to print and circulate for criticism (1) a general syllabus for Secondary Schools; and (2) a scheme of study setting forth the minimum of Geographical knowledge that might fairly be required of a boy on leaving a Preparatory School at the age of fourteen. The first experimental copies of coloured Lantern Slides, made by a new process, on which the Honorary Secretary had been engaged during the past twelve months, had been approved by the Committee, and it was expected that some of the new slides would soon be ready for use. Specimens of the first four maps of the series of Autograph Hand-Maps, designed to take the place of the unsatisfactory Outline and Memory maps in common use, were exhibited at the meeting, and it was stated that they would shortly be obtainable from the publisher. Arrangements were being made with Professor Dodge of the Teachers' College, New York City, for making his *Journal of School Geography* better known in this country, and for supplying occasional papers and notes of special interest to British teachers. Finally, the Committee had the pleasure of announcing that Mr. Douglas W. Freshfield, late Honorary Secretary of the Royal Geographical Society, had accepted their invitation to become the first President of the Association.

In moving the adoption of the *Report*, Mr. H. J. Mackinder, Reader in Geography at Oxford, said that it was a record of solid work and progress in a variety of ways, which would compare favourably with the results of any previous year. He was, however, disposed to question the advisability of getting Geography recognised in the entrance examinations at the Public Schools. To do so might seem to suggest that Geography was an elementary subject which might be laid aside when a boy left the Preparatory School. He also doubted whether it was desirable to issue any general syllabus at all. A bad teacher might wish to have a syllabus prescribed, but the inevitable tendency would be to stereotype teaching and to discourage all originality. And the evil would be greater in proportion to the authority with which the syllabus was invested. The motion was seconded by Mr. A. C. Bartholomew, Reading, and carried, as was also the adoption of the treasurer's report.

The Officers and Committee for 1898 having been elected, the Chairman gave a short address, in which he traced the steps taken by the Council of the Royal Geographical Society during the last eleven years to improve the position of Geography in the educational system of the country. The Council was not, however, an educational authority, nor had it much practical acquaintance with the details of teaching. For this reason, it ought, he considered, to be glad to see its efforts supplemented by the Geographical Association, which had originated independently among the Public School masters themselves, with aims that were not too ambitious but thoroughly practical.

Dr. H. R. Mill, Librarian of the Royal Geographical Society, then gave a Lecture on "Some Hints on teaching Geography," illustrated by a great variety of original lantern slides of maps, diagrams, and scenery. The lecture was followed with keen interest by the representative body of teachers present, and the proceedings closed with a vote of thanks to the Chairman and Lecturer, proposed by the Rev. J. Ll. Dove, Haileybury, and seconded by Dr. A. V. Markoff.

NEW BOOKS.

The Hill of the Graces: A Record of Investigation among the Trilithons and Megalithic Sites of Tripoli. By H. S. Cowper, F.S.A., Author of *Through Turkish Arabia.* London: Methuen and Co., 1897. Pp. xxii + 327. *Price* 10*s.* 6*d.*

This volume contains chiefly the records of a series of archæological investigations, carried on by the author in the districts of Tripoli called Gharian, Tarhuna, and M'salata, during two visits which he made to that country, one in 1895 and another in 1896. He is indebted for the attractive title of his volume to the Father of History himself, who, in the fourth book of his immortal work, writes thus in describing Libya:—"The river Cinyps," he says, "flowing through the country of the Macae from a hill called that of the Graces, discharges itself into the sea. Now this Hill of the Graces (ὁ δὲ λόφος οὗτος τῶν Χαρίτων) is thickly covered with trees, though all the rest of Libya above mentioned is bare. From the sea to this hill is a distance of 200 stadia." This distance, one of about twenty-three miles, takes us to where the hill range commences its slope to the sea, the Hill of the Graces being farther to the west. The Cinyps entered the sea about twelve miles to the south-east of Leptis Magna—the Lebda of our times. This city was founded by the Sidonians, and, like Carthage, rose by commerce and the advantages of its position, to great opulence and splendour. It was the chief of the three cities which formed the African Tripolis, the other two being Œa and Sabrata. Its ruins are of vast extent, but they are buried deep under drifts of sand, and only a very few monuments of its past now appear above ground. These are described by Mr. Cowper, who was, however, unable to make any excavations, all attempts of this nature being strictly prohibited by the Turkish authorities.

Tripolis is the most eastern of the Barbary States, and extends from Tunisia to the borders of Egypt, having a coastline of about 100 miles in length, or about one-third of the whole extent of the southern shore of the Mediterranean. On the south-west it adjoins Fezzan, and on the south-east the Libyan desert. Tripoli, the capital, which represents the Œa of ancient times, is situated on a headland some twelve miles distant from the Tunisian border. It is walled all round, and has a length of about three-quarters of a mile, and a breadth of half a mile. The population, which amounts to 70,000, is mixed, consisting mostly of Arabs, Libyans, Jews, and Maltese. Mr. Cowper has given a detailed description of the place, which visitors will find very useful as a guide-book. The main interest of his work, however, centres in his account of his investigations among the trilithons and megalithic sites which abound in the hill range. Though not the first traveller to notice them, our author can claim the honour of having brought to our knowledge the fact that they are extremely numerous and to be found over a tract of more than sixty miles in length from east to west, and of from fifteen to twenty-six in breadth from north to south. He had to prosecute his researches under great disadvantages, for not only is exploration prohibited by the Government, but the tribes who occupy the hills are extremely jealous of the presence of foreigners, and would not allow any tampering with their monuments. He found a way of evading the prohibition by giving out that he was proceeding to the hills on a shooting excursion. Of his first excursion in this region Mr. Cowper gave a report to the Society in 1895, and his lecture was published in the *S.G.M.*, vol. xii. p. 1. There the term *Senam* is explained as applied in the first place to certain doorlike structures. The two upright stones which form the jambs of the doorway are of heights varying

from five or six to fifteen feet, while the space between them is on the average only sixteen and a half inches. The most remarkable feature in the Senams is that square holes of two kinds (lateral and corner) are to be found in every example. The lateral holes are of a square form and from five to seven inches in diameter, and they stand generally two feet apart. They vary in number and position, but the lowest is commonly found to be two feet above the ground level. The purpose which these holes were meant to serve can only be conjectured. They may possibly have been used as supports for beams which belonged to adjacent structures. At a very large proportion of the Senam sites large slabs of stone are found, generally lying flush with the earth, and when in the proper position directly in front of the Senam. These slabs, which are generally from six to eight feet square, and have a projection at one side, are altars, on the surface of which is cut a square or a round groove whence run two branch-grooves, one to the projection and the other to a side or corner.

With regard to the sites themselves, of which the Senams are the most conspicuous objects, the significant fact is pointed out, that though they vary greatly in detail, they group themselves all under a few types, between which the analogy is sufficient to prove them of a common origin; while the persistence of certain features throughout the sites may be taken as conclusive evidence of the original use of the structures. Our author is able to specify no fewer than ten features, some or all of which are to be found in every site. One of the features of not unfrequent occurrence is the presence of Roman work. This circumstance, however, by no means shows that the remains were of Roman origin, and we must quote Mr. Cowper on this point:—"The Romans," he says, "never stamped out a religion they found in a conquered country, but they adopted it. It is therefore not unreasonable to assume, that whether these phallic forms were actually cut by Roman artisans or by native tribes who had adopted to some extent Roman arts, the artists were representing symbols which had been held before in some sort of reverence in the country" (p. 182). The view which Mr. Cowper takes on the question of the origin of the Senams can readily be inferred from this citation. He sees in them another instance of that widespread reverence for great stone symbols which was at one time universal in the East. This cult spread widely with the Semitic race as it wandered from Chaldæa to Syria, which it colonised, and thence spread itself along the southern shores of the Mediterranean. It is, therefore, not unreasonable to assume that the Senams were objects of idolatrous worship erected by certain of the races of Phœnician descent who colonised the southern shores of the Mediterranean.

Mr. Cowper has illustrated his interesting and valuable work with a sketch map of Tripolis, a plan of Tripoli, and copies of many of the photographs which he took of the ruined sites which he has so well described. He writes in an easy, pleasant style, and his volume will thus be no less acceptable to the general reader than to the archæologist.

From Tonkin to India, by the Sources of the Irawadi. By Prince Henri d'Orleans. Translated by Hamlay Bent, M.A. Illustrated by G. Vuillier. London: Methuen and Co., 1898. Pp. 460. *Price* 25*s.*

In the issues of this Magazine for February and March 1896, we brought to the notice of our readers some of the letters published in the *Tour du Monde* by Monsr. Roux, one of the companions of Prince Henry of Orleans in his journey from Tonkin to India. We have now in this volume the Prince's own account of his adventures in that expedition. It left Hanoi on the Gulf of Tonkin on the

26th January 1895, and first made for Mongtse, *viâ* Laokay. From Mongtse the travellers struck south and west to Ssumao and thence to the Mekong, which they crossed, and then held north by the right bank till they reached Chunning-fu, to the north of which they recrossed the Mekong and made for Ta-li-fu. There they were hospitably entertained for some three weeks by Father Leguilcher, who has been a missionary for forty-five years in China, and had entertained the traveller Garnier in 1863. He also supplied them with a useful interpreter, who, as he knew no French, was obliged to use Latin as his medium of communication to the explorers. Although not Ciceronian, it was quite intelligible. Leaving the hospitable missionaries, the Prince and his companions moved west again to the Mekong, and resumed their ascent of the right bank. They had been specially warned against the Lissou tribe, which seems to have established an evil reputation all along the Mekong for savagery and cruelty; but when the party did at last fall in with the Lissous, they proved to be not nearly so black as they had been painted, and they gave the expedition practically no trouble. At Hsiao-Ouisi the Prince found another set of French missionaries, who had been suffering various sorts of persecution at the hands of Chinese officials. Here, also, the expedition found they were on the borders of Tibet. Marching along the right bank of the Mekong, however, became impossible, so at Halo the party crossed over to the left bank and held on to Tse-kow, where a third band of French missionaries have succeeded in establishing a very promising mission. They have secured from the Chinese authorities a concession of land of considerable extent, and have built a chapel in which some three hundred worshippers attend mass every Sunday. Here the party stayed three weeks, during which the Prince recovered from a severe attack of fever and neuralgia, while Monsr. Roux took the opportunity of going on to Atentsé. They had now gone as far north on the Mekong as they desired, and had to decide on a route by which to return to civilisation. After much deliberation they chose a hitherto unexplored route due west, hoping "to solve the problem of the sources both of the Salwen and the Irawadi, with India for our promised land, approached by a new route."

Up to this stage in their journeyings the obstacles and difficulties met by the travellers had been numerous and trying enough, but they were trifling when compared with what had to be endured and surmounted in the unexplored territory between Tse-kow and India. Every possible difficulty was raised in the important matter of obtaining supplies—the information furnished to the travellers as to routes and distances was usually incorrect—the porters detailed off to carry baggage absconded—tents, etc., had to be abandoned—provisions fell short—some of the party broke down and had to be left behind—in brief, the last stages of the Prince's journey were by far the most trying and perilous of all. Ultimately, however, the whole party reached the English station of Sadiya, where they were cordially received by the Political Agent, whose kindness and hospitality are heartily acknowledged. They had traversed some two thousand miles, fifteen hundred of which had never previously been explored, had seen the snow-clad range which separates the Brahmaputra from the Irawadi, and had ascertained that the sources of the latter are some thirty miles north of lat. 28°, between 98° and 99° E. long. The highest altitude they reached was 12,896 feet, at a col in the chain of mountains separating the Salwen from the Poula Ho.

Interspersed throughout the book is much valuable and interesting information regarding the appearance, costumes, manners, and habits of the tribes which the Prince and his comrades met. He made many inquiries regarding their religious ideas, but his investigations on this point were rarely successful. He succeeded now and then in getting possession of manuscripts, or perhaps they should rather

be called pictorial representations, and copies of some of them are given in an appendix. Other appendices contain useful scientific observations by Monsr. Roux, and notes on Natural History by Prince Henry, and a vocabulary of useful words.

Of course no book can be written by Prince Henry without his having a gird at *perfide Albion*. At one place he says: "The Lissous are very fond of tobacco and spirits. I noticed several of the men, and even one woman, with an earthen flask slung round their necks, from which they constantly took a pull; the result was to make them very loquacious. I thought of the probable effect on those ignorant people of the introduction of civilisation with its vices; and what a fine field for extermination with bad whisky the English would have among them as with the Redskins of North America in the past." Again, reflecting on a document given by the Deputy Commissioner of Bhamo to a relative of a petty chief, he says: "Here we have the inveterate method pursued by England: an advance as sure as it is deliberate, and with no retrograde. The rule of Britain spreads like a drop of oil by a sort of inexorable law of nature and decree of destiny. Assam is one instance, absorbed fifty years ago. Upper Burmah is another, annexed within the last ten. To-day these countries are conterminous: and, united by the English flag, are boring little by little up to the very springs of the Irawadi. To the right of Khamti they are stopped by the ranges of Tibet. They will not go farther to the north-east, for two reasons—the precipitous height of the mountains, and the nakedness of the land. Where no profits are, there is no English flag."

The illustrations in the volume are numerous and remarkably good, and there is an excellent map showing the route of the Prince and his party.

A History of the County of Inverness (Mainland). By J. Cameron Lees, LL.D., F.S.A.Scot. Edinburgh and London: Wm. Blackwood and Sons, 1897. Pp. xviii + 376. *Price* 7*s.* 6*d. net.*

Probably of all the histories in this excellent series Dr. Cameron Lees has the most varied and inspiring theme, for in many ways the history of Inverness-shire may be looked upon as the history of Scotland. Lying as it does in the very centre of the country, and partaking in some degree of the characteristics of all the four races who formerly divided it—Pict and Scot, Scandinavian and Saxon—extending from the almost prehistoric abode of primeval kings at Dunstaffnage to the near neighbourhood of the historic palace at Scone, containing relics of every historic period from the stone circles and vitrified forts of the primitive races to the last battle-ground of the '45, Inverness presents, as it were, an epitome of all Scotland. Dr. Cameron Lees has done ample justice to that part of his subject which he evidently considered to be the object of his work. The historic period from the era of the great clan feuds to the ruin of the Jacobite hopes at Culloden and the wanderings of Prince Charles, a hunted fugitive with a price on his head, has been accurately and graphically recorded, and if other parts are somewhat scrappy and sketchily dealt with, the exigencies of space must be pleaded on the author's behalf. It is to be regretted that in writing the story of Prince Charlie's wanderings he had not before him the two recent works on this subject—*Pickle the Spy*, and the *Itinerary*. Had the work before us been delayed six months, some most interesting details might have been added to this portion.

We should be inclined to question Dr. Cameron Lees' assumption that the beginning of the clan system in Inverness-shire was so late as 1396; and the assertion that the chiefs of olden time ruled on feudal principles seems to require much more evidence to support it than mere statement. Here Dr. Cameron Lees seems

to have forgotten the elaborate account written by the Duke of Argyll of the substitution of the feudal system for that of clanship, and the benefits which Scotland derived therefrom.

It is rather disappointing to find such a very brief and perfunctory account of the Druidic system, the stone circles, the serpent mounds, etc., which abound in Inverness. Dr. Cameron Lees is evidently well acquainted with Celtic literature and tradition, and something of the legends of St. Columba and the extensive translations of Gaelic poetry, interesting as these are, might have been spared to make room for the prehistoric research which has gone far to solving some questions as to the remote past of the county.

Geographically, too, there might have been much more said with advantage. The formation of Inverness-shire is one of the most interesting in Scotland, and though its main features are recorded accurately enough, the space and attention devoted thereto might very well have been doubled with great advantage.

These, however, are faults of omission rather than of commission. Dr. Cameron Lees has set himself to write a county history, interpreting history in its strictest sense, and his best attention accordingly has been given to what comes strictly within the limits of historic periods, and right well he has performed his task. Perhaps it is the very excellence of this part of the book that makes one somewhat hypercritical of the remaining portion.

Taken as a whole, this volume is well up to the high stnadard of its predecessors.

The Voyages made by the Sieur D.B. [*Dubois*] *to the Islands Dauphine or Madagascar and Bourbon or Mascarenne in the Years* 1669-72. Translated and edited by Captain Pasfield Oliver, late R.A., with facsimile maps and illustrations. London : David Nutt, 1897. Pp. xxxv + 160. *Price* 10*s.* 6*d.*

From the beginning of the seventeenth century Oriental colonies became an object of ambition to the Government of France, who envied the Dutch the wealth that accrued to them from their trade with India and the East. In 1643, Louis xiv., then a boy of five years old, under Mazarin's direction granted a concession of Madagascar to the French Société de l'Orient. Colonial enterprise languished during the wars of the Fronde, but in 1665 another expedition was sent out to take possession of the stations founded by the Oriental Society, by this time defunct. It found the natives bitterly hostile to the French, owing principally to the proselytising zeal of the Lazarist missionaries.

The following year a far greater expedition was despatched at the expense of a new Oriental company under the command of the Marquis de Montdevergue, who was created Viceroy of the Indies and Governor of Isle Dauphine, as Madagascar was now named. Montdevergue's mission was a failure, and as the French shareholders refused to subscribe more money, the king felt obliged to send out a third expedition under Admiral de la Haye, who was to take over the island for the Crown.

The Sieur Dubois, of whom little is known, went out in the *St. Paul* in 1669. His narrative is exceedingly interesting in every part. He gives an account of the Canaries and of Cape de Verde, where he landed, and its inhabitants. From here the expedition sailed round the Cape to the Island of Mascarenne, now called Réunion, without touching land. His description of the revels observed on crossing the Line, and of a funeral at sea, show that there is little change in naval ceremonials.

From Réunion Dubois went to Madagascar, and, although he remained there a

year and a half, he saw little of the island owing to an attack of paralysis, but what he tells of its resources shows the true commercial instinct. He went back to Réunion to recruit his health, and it is his description of the remarkable fauna of that island, now mostly extinct, that constitutes the real value of his narrative to modern scientists. His accounts of the Solitaire or White Dodo, of the Oiseau Bleu, a bird allied to the dodo, of extinct parrots, of the giant tortoise and other chelonians, are invaluable to the zoologist. A manuscript copy of the narrative was presented to the London Zoological Society in 1833, but its existence and value seem not to have been known to the members. Captain Oliver has, so to speak, rediscovered the manuscript and translated Dubois' narrative from a rare edition of 1672. His work is of the most thorough and admirable kind. Nothing seems wanting to make the monograph complete. It contains a bibliography, a chronology, and a series of ornithological appendixes. It is prefaced by a clear introduction, and finished with interesting notes and a good index. The illustrations, chiefly anthropological and zoological, are excellent. The translation has just that archaic flavour which suits the period, and the printers have managed to give that slight indication of archaism which suits the style of the narrative. Altogether, it is a thorough and satisfactory piece of work.

The Gist of Japan: the Islands, their People, and Missions. By the Rev. R. B. Peery, A.M., Ph.D., of the Lutheran Mission, Saga, Japan. Edinburgh and London: Oliphant, Anderson, and Ferrier, 1897. Pp. 318. *Price* 5*s.*

In the preface to this book Dr. Peery very modestly represents it as merely an "attempt to give a full treatment of missionary work in Japan." Remembering this, and looking at the subject from this special point of view, we can congratulate him on having presented to his readers a very remarkable and thoughtful work on the past history, present condition, and prospects of Christianity in Japan. In his first chapter the author has sketched an interesting and fairly accurate account of the country and the general characteristics and customs of its people. After this he settles down to his real work, viz., to sketch the history of Christianity in the islands, in the course of which he pays a generous but well-earned tribute to the work of the Roman Catholic Missions. He then sets forth in detail the condition of the Protestant Christianising agencies now at work, with a judicious estimate of their success or non-success, and their prospects. Dr. Peery has formed a very practical but exalted ideal of what a missionary in Japan should be—so exalted, indeed, that we fear that but few men either in America or Europe can attain to his standard. But his deliberate and outspoken remarks on this—to the Christian churches—all-important subject should be in the hands of every mission board, and should be pondered well by all who imagine they have a call to mission work, whether in Japan or elsewhere. They are stated in gentle, kind, but firm and uncompromising language, and, if taken to heart by those interested, would prevent much disappointment and unnecessary or even useless labour. He sets forth with the clear and firm hand of one who has diligently and successfully mastered the subject, the difficulties, problems, and hindrances which beset the missionary when he commences work, the methods by which he can best be trained, the methods by which he can best attain to success, and the means by which he can best be sustained and encouraged by the churches at home. He has evidently studied deeply the Japanese people, and frankly acknowledges their fervid patriotism, their versatility, their nearly univer-al

education, their courtesy, their toleration, their love of independence, and their many other strong points of character; but with real sagacity and insight he recognises that these very qualities are the most serious obstacle to the spread of the Christian faith, which for a local patriotism substitutes the universal brotherhood of mankind, and is intolerant of every other creed. To these inherent difficulties must be added those arising from the seeming opposition of the various sections of Christianity, each of which to the Japanese appears to be engaged in teaching a different religion: the scandals caused by the life and character of foreign Christians; and the waywardness and instability which are inevitable in a young, aggressive, and self-reliant church. It would be obviously out of place in this Magazine to discuss the *pros* and *cons* of such a subject. We must content ourselves with remarking that many, who are interested in the spread of Christianity in what promises to be the greatest nation of the East, will find in Dr. Peery's thoughtful and outspoken work much interesting and valuable information, and much food for profound reflection.

We must add that the illustrations are excellent.

The Romance of Colonisation. India, from the Aryan Invasion to the Great Sepoy Mutiny. By Alfred E. Knight. London: S. W. Partridge and Co., 1897. Pp. 320. *Price* 2*s.* 6*d.*

It is not very apparent how this book finds a place in the romance of colonisation series, for, as a matter of fact, there is no attempt even to describe the colonisation of any part of India. What the author has done is to describe some of the leading events in the modern history of India, more particularly those in connection with the British conquest, which in his first sentence he erroneously calls colonisation. The British have never attempted to colonise India. Climatic conditions render this impossible. It is true that in a few isolated spots—mostly in the hills—there are found some who, with more or less appropriateness, may be termed settlers; but in comparison with the general population they are an infinitesimal number, and do not exhibit any of the characteristics which we invariably find in British colonies. In his preface, the writer says:—"The work is not a history of British India, nor of the East India Company, but an attempt to present in a popular form some of the more romantic and salient features of both." In this limited project he is fairly successful. The book is sketchy and very incomplete, but, so far as it goes, is brightly and pleasantly written. We would prefer to believe that there can be but few to whom the general outline of events in India, which is here presented to us, is not familiar; but if there are persons who are totally ignorant of the history of our great Indian empire, and who shrink from reading it in the pages of Orme, Mill, Elphinstone, Hunter, etc., and who are content only "to read of battles and sieges, of mutinies and usurpations, of imprisonments and escapades, of Oriental treachery and British pluck, of fabulous fortunes rapidly made and as rapidly lost, of sudden rises to power and sudden downfalls, of plots and counterplots," to them this sketch of some of the principal events in modern Indian history may be recommended. Some day, however, the history of the colonisation of India will have to be written—its colonisation not by Britain or by any of the Western nations, but by the Aryan immigration, the events of which are being slowly extracted from tradition, and elicited from monuments by the patient labours of the Asiatic and other learned societies. And when that history is written, it will be found to be deficient neither in excitement nor in romance.

My Fourth Tour in Western Australia. By Albert F. Calvert, F.R.G.S. London: Wm. Heinemann, 1897. Pp. xxviii + 360. *Price* 21*s.*

The title of this handsome volume, the portrait of the author on the frontispiece, and the long list of extracts from reviews of his other writings at the end, where an index should be, tend to convey the impression that it is the work of a noted explorer. Had any geographical discoveries of importance been made during his former journeys, we should probably have heard of them. Certainly the fourth journey was not very successful, at any rate as far as the author was concerned. He was obliged by the effects of the sun to turn back before he had advanced far into the interior, leaving the rest of his party to accomplish the object of the journey—the examination of gold mines in the Pilbarra district—as best they could without their leader. It is by them that the last seven chapters are written. The artist of the party, also, has managed to fill a considerable space with his sketches, though Western Australia does not present scenes very favourable to artistic treatment. The work contains little of geographical interest, and, indeed, the author states that it is written merely "to interest and amuse." Whether it achieves its aim will depend to a great extent on the taste of the individual reader.

At the end of the volume Mr. Calvert styles himself a *Fellow* of this Society, whereas he is only an ordinary member. The fellowship of the Society is an honour conferred by the Council after special investigation of each case, and we are bound, in the interests of holders of the diploma, to protest against any unauthorised use of the title.

On the Indian Hills; or, Coffee-Planting in Southern India. By Edwin Lester Arnold. A New Edition, with Illustrations. London: Sampson Low, Marston, and Co., 1893. 350 pp. *Price* 2*s.* 6*d.*

The writer spent some time coffee-planting on the Anamalai Hills of the Madras Presidency, where, and on the way out, his life appears to have been marked by a series of truly marvellous incidents and experiences. But the effect of the climate on his own health and on that of his companions is hardly likely to attract many to follow in his footsteps. We must protest that the treatment of the punka-coolie, as described at p. 43, is a libel on the Anglo-Indian. Why do writers on life in India so often appear to do their best to represent their fellow-countrymen and women in the most unfavourable light?

Geographische Abhandlungen. Herausgegeben von Prof. Dr. Albrecht Penck in Wien. Band vi. Heft 1.—*Die Seen des Salzkammergutes.* Von Dr. Johann Müllner. Heft 2.—*Seestudien.* Von Dr. Eduard Richter, o. ö. Professor der Geographie an der Universität Graz. Wien: Ed. Hölzel, 1896 and 1897.

In these numbers of Dr. Penck's *Abhandlungen* is given an account of the work from which the atlas of the Austrian Alpine lakes, already briefly noticed, has been drawn. The maps show the contours of the surrounding elevations, and the depths are marked, not from the surface of the water, but from sea-level, so that the isobaths form a series continuous with the contours of the land, and those of the different lakes are immediately comparable. The horizontal scale is 1 : 25,000, and the isobaths are drawn at every multiple of ten mètres. Thus, if the surface of a lake be 494 mètres above sea-level, the first isobath is at 490 mètres, the second at 480, and so on. Thick and thin lines are also used to bring out more clearly the form of the basin.

For the first number of the atlas, which deals with the lakes of the Salzkammergut and the Austrian Traun, the work of several investigators has been utilised, due regard being had to their probable accuracy. Chief among these is Friedrich Simony, who began his work in 1843 and continued it for more than forty years. He employed a hempen rope which was thoroughly soaked before use and then measured, whereby the error was reduced to one or two per cent., whereas with a dry rope it may be as much as ten per cent. The soundings were taken between known points on the banks, and the distance was measured by strokes of the oars. In all 2541 soundings have been utilised on this section of the atlas, two-thirds of which were made by Simony and one-fifth by Dr. Müllner. Simony also instituted observations of temperature, and continued them to the end of the sixties. Lately they have been resumed by Dr. Eduard Richter.

The forms of the lake basins, their drainage areas, the rainfall and discharge, and other subjects are fully treated of in this number of the *Abhandlungen*, and illustrated by diagrams and sections, to which we must refer the reader who desires full information on these points.

The treatise of Dr. Eduard Richter, written to accompany the second section of the atlas, in which the lakes of Carinthia and Carniola and the Austrian portion of Lake Garda are mapped, contains, as its title indicates, many chapters of a general character. To those who have undertaken or are likely to undertake such work themselves, the chapter on methods of sounding will have great interest. In drawing contours of land, when a few points have been fixed by levelling, the intervals can be filled in by the eye, while of the bottom of a lake little can be learned except by soundings. Nevertheless an indefinite increase in the number of soundings is by no means desirable. In small lakes they must naturally be relatively more numerous than in larger. For the rest, their number must be determined by the nature of the locality. The chief point is to determine accurately the inclination and form of the slope, down to the comparatively level middle portion of the lake — the *Schweb*, as it is called in the Lake of Constance.

The positions of the sounding-points are best obtained by taking the soundings from ice. When there is no snow and the ice is not too thick, this method answers admirably, but thick or rotten ice and open water opposite the mouths of brooks are great obstacles. The determination by two theodolites is excellent, provided that the banks have been surveyed with such accuracy that pairs of fixed points can be obtained. The tachymetric method was employed by Dr. Richter in Switzerland, the distance being obtained by observing a decimeter scale on the mast of a vessel through a theodolite, but it was only applicable within a distance of about seven furlongs.

Another method was successfully employed in small lakes during the morning hours, when the surface of the water was smooth. A common log-board, such as may be bought for ten pence, was dropped into the water and the boat rowed across the lake till the line, 100 mètres long, had run out. A sounding was then taken, and the operation repeated.

Dr. Richter also describes his sounding apparatus, and devotes a large number of pages to the temperature observations he and others have made in the lakes of the Salzkammergut. It would be idle to attempt to give any detailed account of the mass of material here digested. Enough has been said to show that Dr. Müllner and Dr. Richter have done their work most thoroughly and have set an example that all limnologists will do well to follow. One curious fact may be mentioned. The lakes freeze when the surface water is cooled down to 1° or 2° C. Water at zero before freezing was never observed. X. Arnet states in an

article in the *Mith. der Naturforschenden Gesell. in Luzern* that in the lake of Lucerne he never found a temperature below 1·25 C. This phenomenon is still unexplained and demands further investigation.

Zeitströmungen in der Geographie. Von Dr. Emil Wisotzki. Leipzig: Duncker und Humblot, 1897. Pp. x + 467. *Price M.* 10.

Dr. Emil Wisotzki has prepared a series of monographs on the history of geographical thought, more particularly from the sixteenth to the nineteenth centuries. He describes these streams of geographical thought in great detail, noting all their changes in direction, depth, and width as they progressed. Each essay bears evidence of the painstaking and thorough research which is characteristic of the best German work, and each contains abundant material carefully arranged and annotated, which will be invaluable for the future interpretative historian of geography. For if there is a fault to find with these learned pages, it is that the wealth of detailed description of the different stages of the geographical thought stream makes it difficult for the reader to form a clear conception of its general direction and development.

The first chapter deals with the different explanations that have been advanced from time to time to account for springs. The second and fourth are somewhat allied, one discussing the aim of geography, the other being on Pure Geography. It is interesting to find in eighteenth century writers vigorous protests against making political geography all, or even the first and essential element in, geography. One chapter gives an appreciation of Karl Ritter, and another is devoted to his treatment of the "vertical dimension." Attempts to solve the difficult problems of the relationship of mountain systems, many of which are still to settle, are dealt with. The different interpretations given to the word "continent" are discussed; and, naturally enough, this chapter is followed by one on the eastern limit of Europe. Is Europe bounded by the crests of Caucasus and Ural, or, as in the case of other continents, should hollows be chosen to separate it from Asia? As there is no natural limit, this is a controversy which may be discussed *ad infinitum*, but were best closed by geographers agreeing to some conventional boundary. The last chapter is on the divisions of Asia.

Dr. Wisotzki has done a great service in summarising the results of his many historical researches in this book, and his numerous references form a useful bibliography.

An Almanack for the Year of Our Lord, 1898. By Joseph Whitaker, F.S.A. London: Whitaker and Sons. Pp. 776.

We again welcome the appearance of this valuable treasury of information. In some few parts it has been remodelled or extended to meet the demands of the times. Mr. Ravenstein, as usual, has contributed the chapters on exploration and territorial changes.

Oliver and Boyd's Edinburgh Almanac and National Repository for the Year 1898. Edinburgh: Oliver and Boyd. Pp. 1193.

The Jubilee year, with its long list of honours, and the numerous events in politics, exploration, etc., that have occurred during the past twelve months, have necessitated a slight extension of the *Almanac*. The present issue has been revised with the usual care, and the most recent events, which occurred too late for insertion in the body of the work, are given on a page of "Additions and Changes."

NEW MAPS.

THE WORLD.

WORLD. Johnston's Commercial and Library Chart of the —— on Mercator's Projection. With enlarged maps of Central Europe, the principal British Possessions, the Suez Canal and Nile Delta, Isthmus of Panama, etc. 6 ft. × 4 ft. 10 in. *W. and A. K. Johnston, Edinburgh.*

On the whole this is a very useful map for the library. As a rule the information is up to date, and all details connected with commerce and communication—railways, telegraphs, coaling stations, steamer routes, etc.—are given. One improvement may be suggested, and that is, the marking more distinctly the railway and telegraph lines; it is not easy, especially in the insets, to distinguish between them. The ocean currents are sketchy, but everything cannot be laid down on one map.

EUROPE.

ENGLAND, Reduced Ordnance Survey of ——. Huntingdon, Cambridge, etc. Essex. Norfolk. Suffolk. Scale of 2 miles to an inch. *Price 2s. each.*
John Bartholomew and Co., The Edinburgh Geographical Institute.

SCOTLAND. The Coolins, Skye, reproduced from the six-inch Ordnance Survey Map, with Names and Heights added from information obtained by members of the Scottish Mountaineering Club.
The Scottish Mountaineering Club, W. Douglas, Hon. Editor.

AMERICA.

WEST KOOTENAY. Geological Map of part of Trail Creek Mining Division. Scale of 1 mile to an inch. *The Geological Survey of Canada.*

ATLASES.

L'ANNÉE CARTOGRAPHIQUE. Supplément annuel à toutes les Publications de Géographie et de Cartographie, dressé et rédigé sous la direction de F. Schrader. Septième Supplément, contenant les Modifications Géographiques et Politiques de l'Année 1896. *Prix:* 3 *Fr.*
Librairie Hachette et Cie., Paris, 1897.

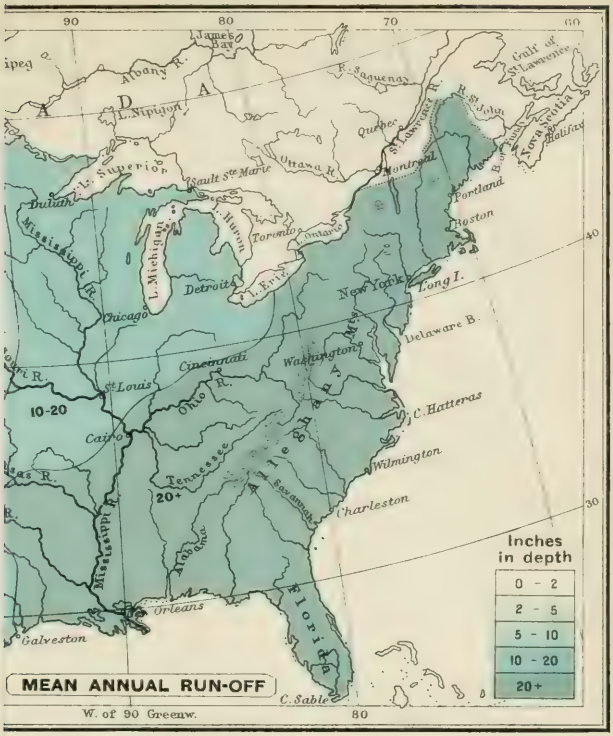
The new number contains, as usual, much useful and interesting cartographical matter. Considerable prominence is naturally given to the work of French explorers—Foureau and Hourst in Africa, Bonin and Chaffanjon in Asia. Why is Sven Hedin's route omitted? A valuable map is one showing the density of population in Russia according to the late census.

SCHWEIZ, Topographischer Atlas der ——, im Massstab der Original-Aufnahmen, nach dem Bundesgesetze von 18 Dezember 1868 durch das eidg. topogr. Büreau gemäss den Direktionen von Oberst Siegfried veröffentlicht. Massstab 1 : 25,000.

Lieferung XLVII :—

No. 5 *ter* Winkel.	No. 253 Walenstadt.	No. 450 *bis* Bernex.
„ 21 *bis* Lauchringen.	„ 256 Berschis.	„ 477 *bis* Chamossaire.
„ 250 *bis* Speer.	„ 364 Schwarzsee.	„ 499 Cerrentino.
„ 251 Alt St. Johann.	„ 450 Vernier.	„ 523 *bis* Chiesa.

Presented by Prof. Paul Chaix.



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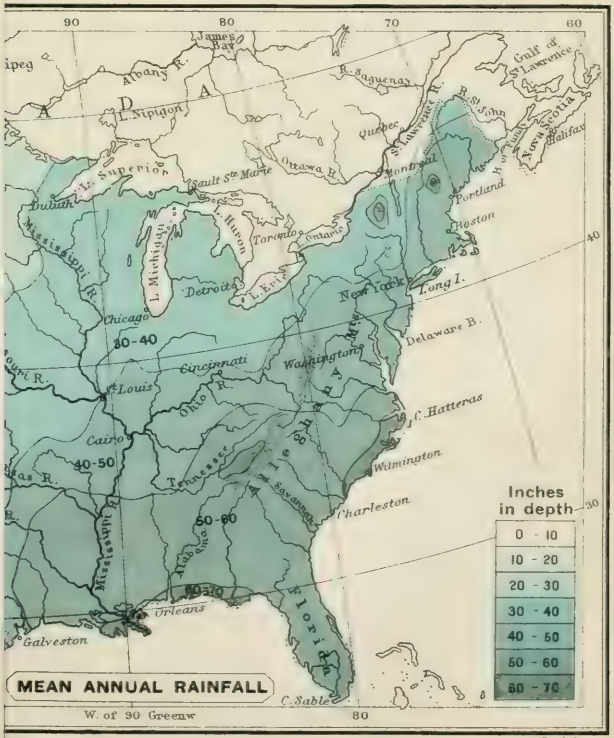

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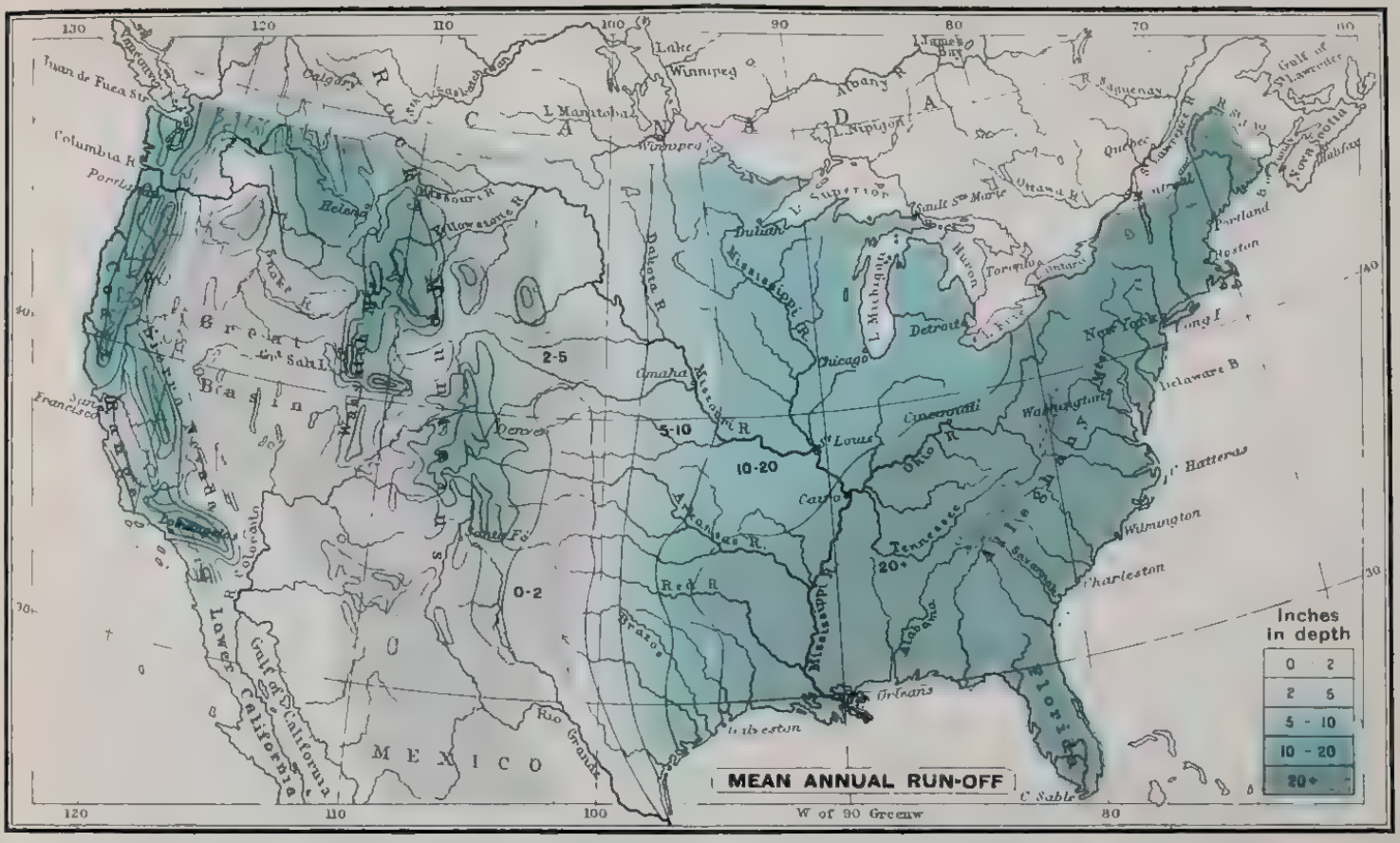
MAPS ILLUSTRATING THE HYDROGRAPHY OF THE UNITED STATES

by Frederick Haynes Newell, Chief Hydrographer U.S. Geological Survey.



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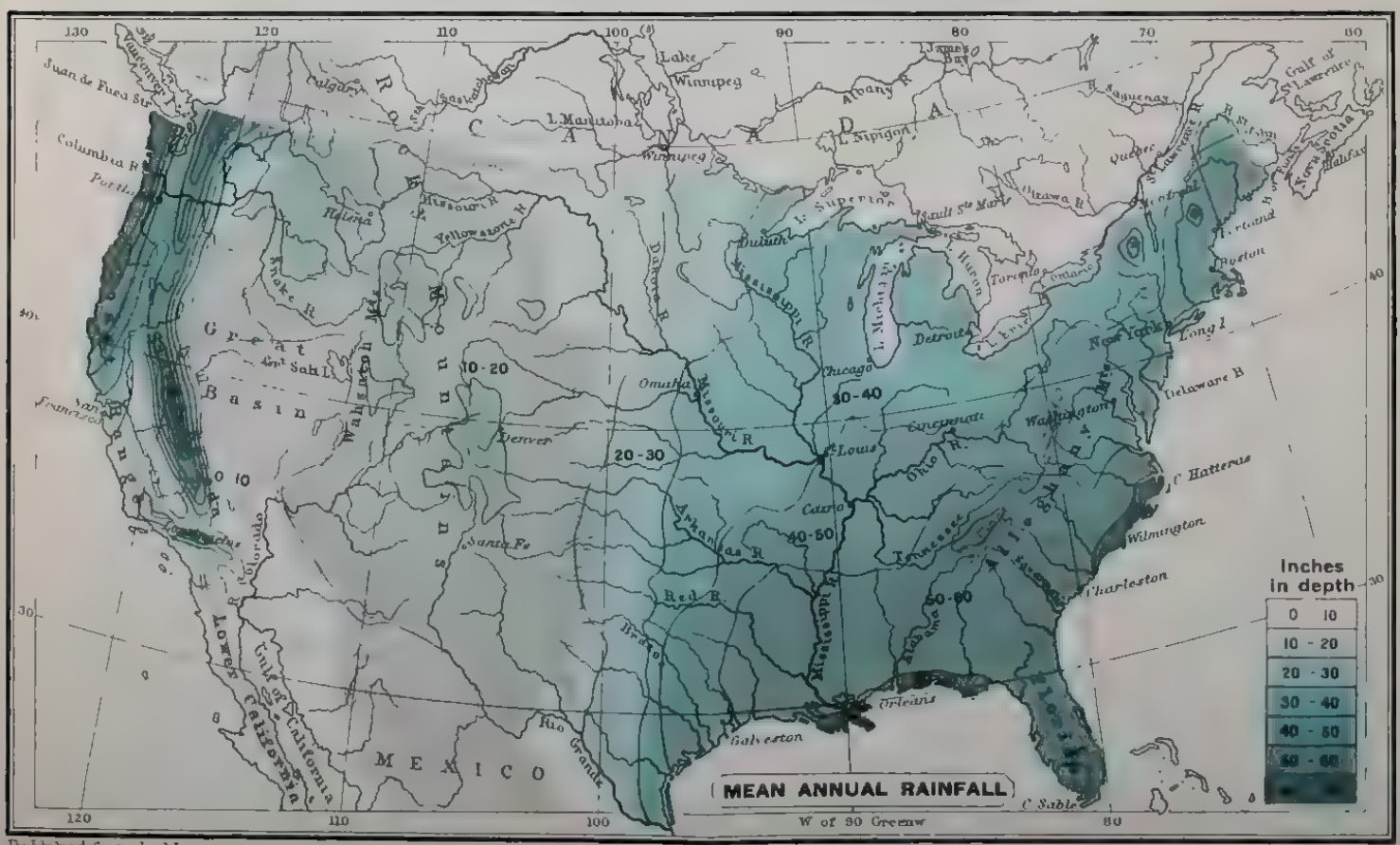

The Edinburgh Geographical Institute

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J G Bartholomew

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

EXPLORATIONS IN THE INTERIOR OF WESTERN AUSTRALIA, BETWEEN COOLGARDIE AND KIMBERLEY.

By The Hon. DAVID W. CARNEGIE.

(*Read before the Society, at Edinburgh and the Branches, in February.*)

(*With a Map.*)

IN the year 1896, having a great desire to penetrate into country as yet untrodden by Europeans, I fitted out at my own cost an expedition for the interior of Western Australia, with the object of ascertaining whether any auriferous country lay between the Coolgardie and East Murchison fields in the south and the Kimberley goldfield in the north, and to find out the nature of the unexplored region between Forrest's route of 1874 and Warburton's of 1873; and, secondly, to inquire into the feasibility of a direct stock route between the two goldfields, or between the Coolgardie goldfields and the central portion of South Australia.

The expedition consisted, besides myself, of Joseph A. Breaden as second in command, Godfrey E. Massie, Charles W. Stansmore, and Warri (an aboriginal boy from the McDonnell Ranges, South Australia). Nine camels, equipment, etc. and provisions for five months were taken.

One of the many drawbacks prospectors have had to contend with in this colony is the high price of good pack-camels. Though now as low, comparatively, as £12 to £15, the price formerly fluctuated from £60 to £80 per head. Indian camels could always be had at a reasonable figure, but for size, strength and endurance, they cannot be compared with those bred in South Australia, probably because on the South Australian stations some care is taken in the breeding, whereas in India the camels are in a much wilder state and breed indiscriminately. However successful the white man has been in improving the breed of

camel, he has been unable to improve upon the pack and riding saddles used in India, the old pattern of pack-saddle being still in favour.

On July 9th a start was made from Coolgardie, heavy rain falling at the time, but unfortunately not extending any great distance towards the interior, and, passing through Goongarrie (ninety miles) and Menzies, we left civilisation at Cutmore's (or Doyle's), some fifty miles south of Lake Darlot. The country between Coolgardie and Cutmore's looked well after the winter rain, grass (a short spear grass of no great value as fodder for stock) and everlastings, pink and white, having sprung up and giving a very pleasing appearance to an otherwise dreary belt of country. A mob of some three hundred bullocks were camped near the well, the first lot to be brought from the Gascoyne to the Coolgardie fields by a direct route. The stockmen told me that they had had no difficulty either on account of water or feed, and had travelled in an almost direct line *viâ* Lake Way and Lawlers. These were the last white faces we saw until reaching Hall's Creek (Kimberley Goldfields) in the middle of December. Taking a general north-east-by-east course, so as to leave Lake Wells on our left and strike Mounts Allott and Worsnop, two very noticeable table-topped hills on Forrest's route of 1874, we crossed an auriferous belt near the southern end of the Neckersgat range (Wells). Here we found good green herbage and bushes, and pools of rain water in small creeks. Numerous prospectors have visited the locality, but so far, I think, no paying gold has been found. This was the last gold-bearing country we saw until well within the Kimberley district.

In longitude 122° 30′ approximately we entered the desert proper, which continued in unbroken monotony to Mount Worsnop. On we marched over vast sand-flats, timbered with desert gums and a few quandongs and acacia bushes interchanging with long stretches of rolling sand-ridges, high and steep in places, but of a far less formidable character than those met with later on. The one characteristic vegetation was spinifex—spinifex in low, straggling tussocks or in high, round compact stools, spinifex with a waving top growth of coarse grass, chin-high, so well described by Forrest as "looking in the distance like a field of ripe corn," or spinifex with bare and naked stools; but everywhere in loathsome profusion grew that most useless and unattractive plant.

Throughout this part of the country, cliffs, terraces, and little low table-lands of sandstone are met with. In these rock-holes may be found, and from them small water-courses run out, only to be swallowed up in a mile or so by the sand. Though in no case did we find water in these creeks, yet the rains of the early winter had caused splendid herbage and green grass to grow on the banks, both excellent feed for our camels. But few natives inhabit these parts, animal life being very scarce and the water supply precarious. During this part of the journey we had our longest dry stage, viz. thirteen and a half days, during which time the camels were without any water, and we ourselves were very hard pressed. Following natives' tracks (even those of quite recent date), we were often only rewarded with a dry rock-hole, or one from which the natives had evidently just taken the last drop. On leaving the comparatively well-watered country, we had come so suddenly into

a dry and desert belt, that we were hardly prepared to stand a long drought. I had foolishly omitted to have every available can or canteen filled at our last watering-place, and in consequence we suffered more discomfort than would otherwise have been the case. On leaving camp in the morning, we would travel from seven to nine hours straight on end with a halt of no more than a minute or two to readjust nose-lines or packs, and would neither have water nor food until our camp had been pitched at night.

Having but one riding camel between five of us, we were on foot the greater part of the day. This training, though rather severe at first, stood us in good stead later on in the year, when the weather was hotter and water harder to obtain, and, indeed, without it I do not doubt but that some, or perhaps all, of us would have succumbed to the hardships of the great Sandy Desert. Besides, walking saved the camels an extra load and many a mile of travel, for when on water-hunting excursions away from the main party, we always worked on foot, and so gave the camels all possible rest. On the thirteenth day, shortly after noon, when leading with the compass, I was rejoiced by the sight of a fresh track, and only some sixty yards ahead of us saw a "buck" engaged in unearthing an iguana. He was captured after a sharp chase, and quickly understanding our wants led us soon after sundown to a rock-hole, which, however, was dry. Partly from necessity, and partly to ensure his going to water in the morning, I allowed him no water to drink. This had the desired effect, for within five miles he took us to a water-hole at which we were able to obtain a splendid supply. This I named the "Empress" spring, a name appropriate to the year of rejoicing over Her Gracious Majesty's long reign.

A very curious water this; between two sand-ridges, some mile and a half apart, is a low out-crop of white limestone in which appear three rock-holes, which one might easily pass within sixty yards of and not notice. On further inspection two of the three holes turned out to be circular shafts, two feet and three feet in diameter, leading vertically into a cave beneath. The floor of this chamber, which is twenty-eight feet across, is some twenty feet from the surface, and is covered to a depth of two feet with sand. From the cave two passages run, one westwards and upwards, the other eastwards and downwards. Along the latter passage one can just crawl to a small pool of water some fifty feet from the surface, evidently a soakage from the surrounding country, and possibly a spring. Though only a small supply was visible, yet continual bailing did not appreciably lower the level of the water. Considerable work had to be done before we could get the water to the surface; the native bailed the water into a bucket, which was passed from hand to hand along the passage to the floor of the cave and then hauled up the shaft.

A rough ladder formed of mulga poles and branches had been used by the natives to go down to the cave, and all along the passage the remains of old fires could be seen. Around the out-crop grows a small patch of buck-bush (or roly-poly grass) and some good camel-bushes. Here we found, too, hidden away in some bushes, a curiously carved flat

board, rounded on the back, and some ten feet long by six inches broad. I do not know the use to which these boards are put, but fancy that they have some mysterious significance and are produced at "coroborrees." From the unusually careful way in which they are hidden, I should suppose that they are valued by the natives.

Around Mounts Allott and Worsnop we found an oasis of some five or six square miles of fair grazing country. Alexander spring we found dry, and in appearance more like a soakage in the shallow bed of a small water-course than a spring, but not five miles south of the spring we saw from the top of Mount Worsnop a fine deep clay-pan. This pan (Woodhouse lagoon), some four hundred yards in diameter, is surrounded by sand-hills and is evidently formed from the drainage off Mounts Allott and Worsnop and the neighbouring cliffs and hills, and into it the creek in which is Alexander spring, after spreading out on to a blood-wood flat, eventually finds its way. Teal and water-hen were fairly numerous, and a few natives were encamped beside the lagoon, but retired on our appearance.

Striking north we shortly got into spinifex country of a new character. Undulations of sand covered with a light gravel of iron-stone, only relieved by the occurrence of belts of blood-woods in the intervening hollows, present a most barren and desolate aspect. The blood-woods, and a species of beef-wood, are the only timber, except occasional thickets of mulga. This gravelly desert extends as far north as latitude 22° 40′. Between Alexander spring and the Alfred and Marie range a few hills and low ranges of sandstone occur, but north of the latter no hard country or hills were seen for a great distance.

A few small and scattered families of blacks inhabit this desert, subsisting on spinifex-rats, boodies (a small rat), snakes, lizards, iguanas, grubs, seeds, and occasionally doves or pigeons, an emu or kangaroo (of which a few exist in the Young range) very rarely falling to their lot. For water they depend almost entirely on native wells, which yield a scanty and unreliable supply. Forced from the nature of the country, scarcity of water, and their peculiar method of hunting, viz., by burning large tracts of spinifex, to be always wandering, they seldom camp for more than a week or two in one place, and do not build any sort of house or shelter.

Having set a light to a patch of spinifex, the natives surround the blaze as far as their small numbers will admit, and with throwing sticks and spears knock over the rats or other animals or reptiles as they try to escape from the burning spinifex. So soon as a patch of country has been burnt, the "gins" and "picaninnies" go carefully over the ground with a pointed stick in one hand and a wooden "cooliman" in the other, gathering up any lizard, snake, or grub which has perished in the flames.

When the country immediately surrounding the well at which the tribe is camped has been burnt out to a radius of some four or five miles, they wander on to another well. The Australian aboriginal is not noted, as a rule, for his provident habits, but these desert natives have some thought for the future, in that they are seldom found encamped at

a good water. The small native wells are used first, and, when these and the rock-holes are exhausted, then the more permanent waters are resorted to. As well as the rats, etc., on which they chiefly live, they gather an edible bean not unlike the bean of our English broom, which they roast over the wood ashes and eat with evident relish, though to us its taste was most unpleasant, being very bitter. A small yellow seed they grind on a flat stone with a small round ball of granite (evidently obtained by barter and brought from a distance), which, mixed with a little water into a paste, is baked into a very black and unpalatable-looking cake. Though feeding, as a rule, only night and morning, they sometimes sit down and cook and eat a rat as soon as it is killed. Everything is eaten in a half-cooked state, and the process of preparing a meal is simple in the extreme. Rats are plucked and thrown on to the hot ashes without any preparation, and are greedily devoured red and bloody, and but barely warm. A lizard or iguana calls for a further exercise of culinary skill. First a crooked twig is forced down the throat, and the inside pulled out and thrown to any dog or child which happens to be near; the reptile is then placed on hot coals, until distended to the utmost limit that the skin will bear without bursting, when it is removed to somewhat cooler ashes and covered with the same, and after a few minutes is pronounced cooked and ready for the table. The old gins usually do the cooking, incessantly chattering and swearing all the time. The natives drink twice a day, on going out and returning from hunting, swallowing such an enormous quantity of water as to visibly distend themselves. Using no shelter or "mia" of any kind, they sleep two or three together in a hollow scraped out in the sand: between each hollow a little fire is kept burning all night in the cold weather, replenished from a bundle of sticks and roots kept handy for the purpose. To break the force of the wind a fence is made of uprooted tussocks of spinifex, some two feet high, and behind this they lie coiled up higgledy-piggledy like a litter of pups.

Poor as is the supply from the native wells, it lasts the blacks a considerable time, as, except for drinking, they make no use of water. From what I have seen of these wells, I judge them to be simply rock-holes which have been filled in and covered by the general deposit of sand. In some few there seems to be a very slight soakage, but, as a rule, when we had finished with a well, it presented the appearance of an empty rock-hole from twelve feet to as much as thirty feet in depth. As there is no soakage into the well, the sand immediately around is just as dry as elsewhere, and in consequence no grass or herbage grows. Except native camps or tracks, one has no guide whatever to these wells, and might easily pass within a few yards without seeing them. The plan on which we worked was as follows: Almost every day, usually at about 9 A.M., we would see columns of smoke arising in various directions. Choosing one in the direction nearest to that in which I wished to travel, I would take a bearing with a prismatic compass, and travel on that bearing until the fire or the burnt patch of country was reached. Sometimes these fires, though appearing quite close, would prove to be thirty miles off, and pretty accurate steering was required to hit off the exact

spot where a fire had been. Having reached the spot we would, if possible, surprise natives whilst they were hunting, and secure one or more, or, failing that, we would pick up the tracks of the lighters of the fire and follow them until the camp was found. This often entailed hours and hours of patient search, for so many footprints surround the burnt country that it is hard to single out the tracks leading camp-wards. On our approaching a tribe, astonishment and awe would keep them spellbound for a few minutes, and then up and away they would run, helter-skelter, leaving all behind them, some hiding behind bushes, others climbing into trees, and a few of the bolder spirits, after the first retreat, awaiting our arrival with but ill-assumed confidence. It would often happen that they had only one or two of us to deal with, the main party being behind, and then they were bold and saucy, and sometimes ready to dispute our unceremonious entry into their country. A young gin or small boy would always show us the camp and well without much hesitation, a buck sometimes, but an old lady never; the old women are the hardest to manage and are quite untameable, yelling and screaming, kicking, scratching, and biting, spitting, and presumably cursing, until one is by no means sorry to be quit of them. A buck being secured—or two, if possible, for they fret less in company and sooner get over their fear—should he take us to water at once, well and good; but if not, we took him with us, and after one night without water he was generally only too anxious to start. When thirsty, the natives travel very straight and at a great rate, with long swinging strides, often carrying a short stick behind the shoulders like a back-board. A trial will prove that the position one's arms take in holding the stick expands the chest and opens the lungs, and certainly makes rapid walking easier.

On arrival at a well our troubles, far from being over, were only just beginning, and long hours (often days and nights without rest) of hard work lay before us before we could procure a store of water for our camels or ourselves, though we could get sufficient to quench our thirst whilst we worked.

On first acquaintance with these wells, one would suppose that it was only necessary to dig out the sand until the bottom was reached; but the water is held in the sand and is shovelled out with it. Nor is it possible to scoop out a hole in which the water may accumulate, for the surrounding sand falls in again at once. The natives use so little water at a time that, as the water sinks, they can scoop out the sand very gradually and plaster it round the sides of the well and so prevent the inrush of sand. As often as not they do not bail the water at all, but suck it up from the sand through a bunch of grass.

Luckily, amongst our gear we had two galvanised iron boxes made with deep lids, on the same pattern as those of a commercial traveller. By sinking the boxes in the sand in the well, and digging out the sand contained in them and then patiently waiting with a pannikin for the small trickle of water creeping in from between the outside of the boxes and the sides of the rock-hole, and then again forcing the boxes lower and continuing the bailing process, we were able to drain the native well

so thoroughly that by the time we had finished only a few drops would be left at the bottom.

The water from these wells always had a nasty taste, and boiling brought a thick scum to the surface. Tea made with it turned quite black. Iron the water certainly contained, but, besides that, the remains of birds, lizards, sticks, and other rotting vegetation, which, with the flavour left by countless bucks, gins, and picaninnies, combined to make a not very wholesome beverage.

So wretched a supply do these wells yield, that after as much as four days' and nights' constant work we were sometimes only rewarded by a hundred to a hundred and eighty gallons, seldom enough to water the camels and fill the cans at the same well, and week after week for nearly five months we had one continual battle for water. Patience well, which we cleaned completely out to a depth of near thirty feet, after working day and night for three days, produced but one hundred and forty gallons.

On dry stages we found that oatmeal was the most serviceable article of diet, as with the expenditure of only a very small amount of water, porridge sufficiently good and strengthening to last one all day can be made.

The weather was now very hot for the time of year, and the temperature increased daily, though in the early mornings a cold east wind invigorated us to bear the coming heat of the day. We passed over large tracts of burnt country from which the strong winds were continually blowing clouds of black dust and ashes, and small spiral winds—"willy-willies"—frequently shot up black clouds into the air, in which, many feet overhead, bunches of spinifex, small branches, and grass were whirled rapidly round.

On September 19th, after leaving Family well in lat. 20° 40′, we entered the most miserable and barren desert it is possible to picture, and from this date until November 16th we were never out of sight of a sand-ridge. From lat. 22° 40′ up to lat. 20° 45′, there stretches a vast howling wilderness of high spinifex-clad ridges of red sand, so close together that I compute that in an average day's journey of seven hours we crossed sixty ridges, so steep that the camels had often to crest them on their knees, and so barren and destitute of vegetation (saving spinifex), that one marvels how even camels can pick up a living. I should estimate that their average vertical height from trough to crest would be fifty to sixty feet at least.[1] With almost heart-breaking regularity they keep their general trend of north-by-east and south-by-west, making travelling the more difficult and tedious, as from our northerly course we were always crossing the grain of the country. Moreover, these troughs and waves seem to be corrugations in the surface of greater undulations, for during half a day's or a whole day's march, on reaching the top of one ridge we found a higher one in front, and, similarly, the next part of our journey would be over ridges gradually sinking before us. I am utterly

[1] Average height of sand-ridges crossed by Col. Warburton, 80 feet; seen by Gregory, 30–60 feet.

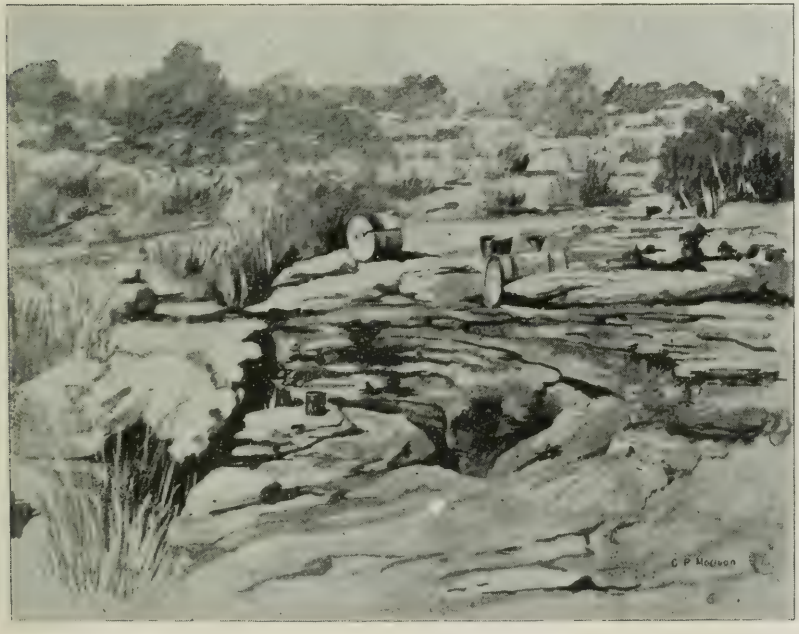
unable to give any conception of the ghastly desolation and awful, hopeless dreariness of the scene which meets one's eyes from the crest of a high ridge. The barren appearance of the sand is only intensified by the few sickly and shrunken gums that are dotted over it, with the omnipresent spinifex; true it is, though, that even this poverty-stricken plant has its uses, for it serves to bind the sand and keep the ridges for the most part compact. Where spinifex does not grow—that is, on the crest of the ridges, probably kept back by the wind—one realises how almost impossible it would be to travel for long over dunes of loose sand.

One can appreciate the many good qualities of the camel in such country as this. Poor, kind, and noble-hearted beasts, with what patience and undaunted courage do they struggle on with their loads, never complaining and never giving in until they drop from sheer exhaustion! Night after night we searched in vain for any feed; after wandering in their hobbles, picking up a few scattered mouthfuls from a dry and shrivelled thistle-like weed (good feed when green, being full of sticky white juice), tired nature would at last give in, and, empty-stomached and well-nigh worn to death, they would lie till morning, until again dragged relentlessly across several dozen more ridges.

All through this wretched country live small families of natives (eight or nine together), and, strange to say, they are by no means small or ill-made—rather the contrary, some bucks being upwards of six feet high. On the whole they are a finer race than those seen farther south about the Eastern Coolgardie fields, and the reason is not far to seek, for the southern black either feasts or starves, once in a while killing an emu or kangaroo, and in the meantime living upon "bardies" (large white grubs found in the roots of a shrub) and similar fare; whereas the desert native has always a full larder, even though it contains only rats, lizards, etc. On their return from hunting, one sees the bucks marching home with the spoils of the chase strung by the tail in the hair-girdle that they wear round their waists, and the ladies following behind with "coolimans" brimful of bob-tailed lizards, sleeping lizards, rats, and other choice delicacies. These rats live upon the roots and the young plants of spinifex, and as far as I could ascertain, do not require water; were they able to go down and come up again from the bottom of a native well, which it would not be possible for them to do, they would certainly leave well-beaten paths leading to the water, and these are not to be seen. Spinifex contains a considerable amount of turpentine, and from the roots the natives make a kind of gum, so that I presume sufficient moisture is obtainable from it to keep the rats alive.

Whilst hunting or travelling the natives get some satisfaction, and I suppose a certain amount of nourishment as well, from the pulp of a certain plant which they chew—something of the nature of the "pitcheri" used by the Queensland blacks. Cleaning and smoothing a space in the sand, they light a small branch from a silvery-leafed shrub, of which the leaves when burnt form a very fine white ash. This ash they mix with the stalk of an herb not unlike a carrot, which has been already chewed, and squeeze and press the compound into a small, oval-shaped ball of a sticky and stringy consistency. The ball, when in use, is passed round

IN THE VICTORIA DESERT.



ENTRANCE TO EMPRESS SPRING.

WOODHOUSE LAGOON.

NATIVE CAMP.

from one to another to be chewed in turn, and when not in use is carried behind the ear like the pen of a clerk. Our captives, being of necessity debarred from hunting, had to live on our food, which as a rule appeared to be unpalatable to them, but, so long as they could obtain the necessary plants and could have a good chew, they were content.

The natives are by no means free from disease, and both at Family well (lat. 20° 40′) and at Jew's well (lat. 19° 40′) we found natives—one a buck, the other a gin—suffering from horrible running sores, covering the arms, legs, chest, and back, and accompanied by a swelling of the joints. We doctored them with Stockholm tar and linseed oil (a mixture used for mange in camels), which seemed to give them some relief. Disease of the eye is not uncommon; one poor little boy had the inner corners of both eyes completely eaten away, cavities being formed into which one could easily put the tip of one's thumb. Wounds and scars from burning are of common occurrence, as the natives sleep very close to their small fires, and the babies and children are carelessly thrown down close to a fire and left to roll in and have an arm half-charred, or be merely blistered and roasted, as chance may direct. The mothers care very little for their children, and the elderly ladies especially take more interest in, and show more affection for, a litter of domesticated dingo pups. When a tribe has been in full retreat on our approach, I have seen an old gin stop and then turn back to the camp to pick up some small puppies, and yet when, as sometimes happened, we had a small boy in captivity, no attempt at rescue was made.

Amongst the weapons and treasures in a camp are nearly always found several bundles rolled up in a covering of bark, and tied round with hair-string. In these bundles are carried all sorts of finery—plaited bands of string for the arm or wrist, sporrans of tufts of dingo hair or the tips of rats' tails, necklaces of beans; carved sticks, flat or round; pieces of quartz or opaline for making carving-tools; a sort of red ochre and a white substance from which they make paint for decorating themselves; bunches of emus', crows', or hawks' feathers; a few bones of birds or rats for putting through the nose; and numerous other odds and ends. As evidencing the extent to which the natives trade among themselves, I may tell you that in camps as far in the interior as Helena spring and Family well we found such things as pearl-oyster shells, worn slung round the waist for a sporran, lids of tin match-boxes, an iron tentpeg, a piece of a saddle-tree, a piece of glass carefully packed in a case of feathers and grass, and tomahawks made from old iron, apparently part of the tire of a dray-wheel. This trade is all the more curious when one considers the small extent of country to which one family is confined, and also the changes in language within a very short distance. I should say that about seventy or eighty miles would be the very longest distance that any native could travel without leaving his own particular district. On our return journey, two bucks caught near Mount Elphinstone knew no waters beyond Stansmore range, where we liberated them.

I think it probable that there are no natives who have not heard of the existence of the white man, though doubtless to many we are as little known as the pygmies of Africa were to the Ancients. On one occasion

a buck, on being restrained from an attempt at escape, lay struggling on the ground screaming out a string of what under the circumstances we took to be oaths and curses, amongst which the word "white pfella" could be distinguished. The blacks nearer the settlements add the word "womany" to their English vocabulary. At Helena spring the buck that we had with us would look on quite unmoved while we shot the small tufted pigeons which came to water in fair numbers, whilst farther north, at Jew's well, on my picking up a rifle, a general stampede took place of the natives who were surrounding us as we worked at the well, somewhat impeding us by their inquisitiveness.

Helena spring, a small basin in an out-crop of limestone fed from some subterranean source, is surrounded by a little oasis not more than four hundred yards wide, where splendid herbage of a thistle-like appearance and numerous good camel-bushes grow. Outside this welcome spot, away to the horizon on all sides, stretches the desolate sea of sand-ridges, at the time of our journey looking all the more inhospitable and dreary from having been recently burnt. The basin contains no more than seventy gallons of water, but, after emptying, the water rises rapidly again, and before long regains its former level, nearly flush with the surface. Here we camped some few days, allowing the camels to enjoy to the full the good feed and unlimited supply of water, not sorry ourselves for a few days' rest, which we spent in washing, mending clothes and saddles, writing diaries, and in numerous little duties which had necessarily been somewhat neglected. Who can picture the satisfaction and relief at finding oneself at a good water, easy of access and never failing, after weary days and nights of toil in the wretched native wells? What a godsend this spring was to us!—without it, it is hard to say how we should have fared, for the camels were well-nigh exhausted from heat and want of feed, and had been coaxed along with the greatest difficulty. The sand during the day became so overpoweringly hot that the camels would not stand still, and whenever a halt was necessary to adjust a pack or nose-line, some would break away and drop down in the wee patch of shade afforded by some small bush or shrub, and those that stood kept lifting their feet continually. The buck we had with us suffered more from the heat than we did, and would hurry forward whenever a tree came in sight, straining at the rope or chain like a dog at his leash, throw himself in the shade of the trunk (for the scanty foliage afforded no shade), and with a stick dig a small hole in the sand, bringing up from a foot or so below the surface handfuls of cool sand with which to anoint his legs and arms. Sometimes he mixed with the sand his own urine, plastering the mud so formed over his head or body. To two dry wells he took us, until our patience was nearly exhausted, so we resorted to the unfailing argument of allowing him no water until he guided us aright. The outcome of this was the finding of Helena spring, on arrival at which our friend was most anxious to plunge into the basin of water, so eager was he to alleviate his thirst.

It may sound a cruel thing to keep a man without a drink, but it must be remembered that our lives depended on the native's showing us water, and, if unwilling to do so, he had to take the consequences. And

while he had no water for, perhaps, thirty hours, we, working and walking, had no more day after day than would just suffice to keep body and soul together.

From latitude 20° 50′ to latitude 19° 20′, the monotony of the desert was somewhat broken by detached blocks and tablelands (the Southesk tablelands) of sandstone, presenting in the distance the appearance of bold headlands, cliffs, and points, such as one sees on the sea-coast. These are in some cases some two hundred feet above the surrounding country, with sheer rocky faces and tops more or less flat, from which stand out conical peaks and summits like so many gigantic mole-hills. From the highest cliffs the sides gradually slope away, until at a distance of some three to six miles they merge into the surface of the tableland. Barren of all trees, except here and there a fig which somehow manages to exist, finding a foothold in clefts on the face of the rock and sometimes hanging into space, and innocent of all smaller vegetation but spinifex, these hills present a most forbidding and desolate appearance. In the valleys between the headlands and around the foot of the cliffs a narrow belt of fairly good grass grows, and cleared out by occasional thunderstorms rough and steep little gorges and glens give rise to narrow though deeply scored water-courses, which with their fringes of bushes and shrubs are soon swallowed up by the all-devouring sand. From the appearance of these little creeks I should judge that very occasional, but very violent, thunderstorms must visit this region. The beds overgrown with spinifex show that running water is of infrequent occurrence, whilst the upturned roots of trees, large boulders, and broken fragments of rock strewn about in wild confusion, and channels torn out through the sand down to the bed-rock beneath, give one the impression that some powerful atmospheric agency must sometimes be at work. Whilst we were amongst these tablelands, the weather was broiling hot, and night after night we experienced terrific thunderstorms, but, alas, unaccompanied by rain. Every evening the clouds would bank up black and threatening, the heat would be suffocating, making sleep impossible, lightning would rend the sky, and then, after all this hope-inspiring prelude, several large drops of rain would fall and no more, the sky would clear, and the performance be over, only to be repeated the following evening.

At the head of one or two gorges we found some large rocky pools, usually situated underneath an overhanging ledge of rock. The largest of these (Godfrey's tank), in a position almost inaccessible to camels, I estimated to contain when full about forty thousand gallons. When we found the hole, it held sufficient water to enable us to have a good bathe before leaving it.

From Godfrey's tank to Mount Bannerman there is another uninterrupted stretch of sand-ridges, and one well with a good supply (lat. 19° 40′). To this we had tracked a tribe of some twenty blacks, of whom the most noticeable feature was their pronounced Jewish cast of countenance—fine big men most of them, very inquisitive and bold. To the east of this well a belt of black desert-oak stretches, the first we had seen.

Near Mount Bannerman we had our first mishap, losing three camels from a poisonous plant. We were forced to camp, on account of Breaden

suffering from a bad attack of dysentery, and Stansmore being also unwell, and though we moved the camels on to fresh feeding-ground twice, we were unable to avoid the poison, and on three successive nights a camel died, evidently very suddenly and in great agony. Another was taken bad in the morning and ran and galloped round in circles, now and again dropping to the ground and rolling about in pain; presently we roped him down, and by bleeding him saved his life. I could not discover which bush it was that was so fatal, and could only be thankful that we lost so few animals. One day after passing Mount Bannerman we had left the desert of sand-ridges behind us. Here we saw, in the shape of horse tracks, the first signs of white men since sighting Forrest's pile of stones on Mount Allott. Our journey through unknown country was at an end, and along the banks of the creeks and rivers in the Kimberley country, into which we shortly entered, our path lay through pleasant places; shady trees, long grass, and frequent pools of water in the shingly beds of the creeks, alive with fish and ducks, made a welcome change after the awful desolation of the desert. The Kimberley country is too well known to need any further description from me. Let it suffice that we followed up the Margaret river to the crossing of the Derby—Hall's Creek telegraph line, and along the latter to Hall's Creek, the official centre of the Kimberley goldfields. Our joy and self-congratulations at having overcome the dangers and difficulties of the desert were doomed to be short-lived, for a most deplorable accident, resulting in the death of poor Charles Stansmore, took half the pleasure from our hard-earned victory. For some time past we had exhausted our supply of meat, and it had been customary for one of us to carry a shot-gun and follow up the opposite bank of the river, or walk wide of the line of march, on the chance of shooting a kangaroo, of which we saw a fair number when once out of the desert. On the 30th of November, Stansmore was carrying the gun, and on climbing down a steep face of rock his heels slipped, the gun came forward, striking the hammers on the rock at his feet, the cartridge exploded, and the charge entered his body just below the heart, death being instantaneous. I cannot describe our sorrow at the side of poor Charles's lonely grave. A good and true and a man in every sense of the word. It was better thus than a lingering death from thirst in the desert, and yet how hard it seemed to die on the edge of the promised land, with the bad country passed and left behind!

We reached Hall's Creek on December 4th, having travelled some fourteen hundred miles, and here we remained until March the 20th, the guests of the most hospitable warden, Mr. Cummins.

Hall's Creek, named after the prospector Hall, is the official centre of the once populous Kimberley goldfield. This goldfield was discovered in 1882 by Mr. Hardman, Government Geologist attached to a survey expedition under Mr. Johnston (now Surveyor General), who found "colours" in numerous localities. But it was left for prospectors to find payable gold, and early in 1886 one of the largest and most unprofitable "rushes" known in Australia set in for the new-discovered alluvial field. The sinking being shallow, what ground there was was soon worked out, and before long the "rush" set back again as rapidly as it had come, and

the goldfield was condemned as a "duffer," and left to the few faithful "fossickers" who have made a living there to this day. The alluvial gold was the great bait, and of this but little was found, and to reefing no attention was given, so that at the present time miles upon miles of quartz reefs, leaders, and blows are untouched and untested, as they were before the "rush" in 1886. No one can say what systematic prospecting might disclose in this neglected corner of the colony. There are many countries less favoured for cheap mining. Kimberley is blessed with an abundant rain-fall, and the district contains some of the finest pasture-lands in the continent of Australia. The roads, except during the rainy season, are good, and cartage from the port of Wyndham (200 miles) should not be a very costly item. A scarcity of good mining timber, the remoteness of the district from settled parts, and the bad name that has been bestowed on it, are the disadvantages under which the goldfield labours. For all that, two batteries are working at the present time, and a good find by some old "fossicker" is not so rare.

The present population of Hall's Creek is about twenty; this is augmented occasionally by the influx of "overlanders" from the Northern Territory and Queensland.

The gold-bearing country is cut off to the south-east by what is locally known as the "Sandstone," a bluff, wall-like range named the Albert Edward range. In the same direction, between the Sturt and the border, "colours" of gold have been found, and the existence of this narrow auriferous belt, well known to the present prospectors in Kimberley, to the eastward of Messrs. Stretch and Week's station in the Sturt, gave us faint hopes that the same belt might be met with to the southwards. But to this I may say we pinned little faith, and beyond the feeling that we were doing a certain amount of good to the community in general by going back through unknown country instead of making an uninteresting and useless journey by the coastal stock track, we had little thought of any practical benefit resulting from our work, unless it were the opening up of a stock route between the cattle country of Kimberley and the southern goldfields; and of this I had but little hope after our former experiences. It needs no expert to say in most decided terms that such a route is utterly impracticable, for, when in the best of seasons it would be a matter of extreme risk to bring over a mob of, say, one hundred camels, what chance would a herd of cattle have of getting even a quarter of the distance? I think any one reading a short account of the style of country encountered by us will be of the same opinion as myself.

We left Hall's Creek on March 22nd—a place I shall long remember for its kindness and hospitality.

Our party consisted of Messrs. Breaden and Massie (companions of my former journey), two black boys (one our faithful Warri and the other a Sturt Creek native, Tiger by name, an excellent boy, but one who looked after his own comfort so well that he left us on the first signs of the desert), eight camels, and three horses. I have always held that it is a great mistake to mix camels and horses in such country as this, and, indeed, on a former journey in 1894, I had some experience of the

troubles connected with horses. But for some time past I had been holding myself in readiness to go in search of the lost members of the Calvert Expedition, and daily expected a telegram asking me to start; for I had agreed to await the result of Mr. Ruddall's and Mr. Wells's searches. Now, had we gone on this search expedition, my plan of operations would have been to travel down the Sturt as far as the lakes, and thence make west some sixty-five or seventy miles to Godfrey's tank, where we were sure of getting water, and there form a camp. In working out from that water by slow degrees to the westward, the horses would have been extremely useful in hunting up the natives and finding waters to which we might move on the camels, saving time and a considerable amount of pretty stiff walking. At length Mr. Ruddall returned, having found the bodies of the two men—who turned out after all to be the wrong ones—and Mr. Wells was again starting out, shortly to be followed by Mr. Ruddall: and so many months had elapsed since the first reports of Messrs. Wells and Jones being missing, that I decided to return towards Coolgardie, as I had originally intended. Luckily, at the last moment I was able to purchase three camels belonging to the South Australian Government, then in the hands of Mr. Buchanan, which raised the number of my troop, then reduced to five, to eight. The horses were a nuisance and an encumbrance to us so soon as ever we got into bad country, but by allowing them one bucket (three gallons) apiece nightly, we managed to keep them alive for the extraordinary periods of eight, nine, and ten and a half days—extraordinary, not so much on account of the short allowance of water, as on account of the almost total want of fodder and the extremely trying nature of the country they had to cross, more trying, I think, to horses than camels, for their hard hoofs cut into the soft sand. In many places the utter sterility of the country would not allow even the spinifex to put forth as usual its tops of coarse grass, and on several occasions both camels and horses were forced to content their hungry stomachs with the prickly stools.

On leaving Hall's Creek, both Mr. Breaden and Mr. Massie suffered severely from sore eyes. At Flora Valley we were hospitably entertained by the brothers Gordon, and a few days spent in a dark room cured Mr. Breaden's eyes completely, and Mr. Massie's very nearly. Here we loaded up with beef, the Messrs. Gordon, with true squatters' liberality, giving us a fine bullock. Crossing those splendid grass plains, the Denison, discovered by Gregory, we reached the Sturt Creek, which has been so well described by that famous traveller that I need say little about it. Following the track down the creek, we arrived on April 1st at Mr. Stretch's homestead, the most southern settlement in the East Kimberley district. The Sturt, which up to this point creeps sluggishly through a broad line of blue-bush (*Atriplex*) swamps and flats, in no well-defined channel, is here confined between two rocky ridges of sandstone, and spreads out into a fine water-hole some five or six miles long and, so far as I remember, about three hundred yards across. Mr. Stretch accompanied us down the creek as far as its junction with the Wolf (so named by Mr. Stretch), which lies some few miles north of the border of the Kimberley district. Above the junction are the same swamps and

flats, giving place to large rock-bound pools wherever a sandstone ridge runs across the course of the creek. Below, the combined stream takes on itself the character of the Wolf, which, in common with all the Kimberley creeks seen by us, is fringed with large gums, Leichhardt pines, and *Bauhinia* trees. The Wolf has, I think, the greater volume, though the Sturt is certainly deeper, and, seeing that the Wolf, which rises somewhere on the opposite slope of the watershed to Christmas creek and the Mary river, floods twice or thrice a year, whereas the Sturt runs its entire length but once in every three or four, it must be, I imagine, to the former that the lakes (Gregory's "Salt Sea") owe their existence. However that may be, the combined waters of the Wolf and Sturt fill but an insignificant channel, and one can hardly credit that this creek has a length of nearly three hundred miles. From the confluence downwards a war between the desert and the grass lands is waged for the supremacy of the river's banks. For miles the sandy channel, less than one chain wide in places, is hemmed in on either side by desert gums and spinifex, and once out of sight of the creek, the surrounding country receives no benefit from the water. But lower down again, noticeably about the latitude of Mt. Müller, the grass plains gain the day, and a very pretty bit of country it is, too, especially when the creek is running, as it was when we were there. In many places its waters had overflowed the banks, expanding into clay-pans and lagoons of beautiful clear water, where teal and whistling-duck disported themselves. On nearing the lakes the creek assumes so dismal an appearance, and so funereal is the aspect of the dead scrub and dark tops of the "boree," that one wonders that Gregory did not choose the name of "Dead" instead of merely "Salt" Sea. A curious point about this part of the creek is that stretches of salt and fresh water alternate. Unsuspectingly camping one night on its banks, we were forced after tasting the water to turn back several miles before we could get any fit to drink. The lake itself is a fine sight. To see so large an expanse of water is a rest to the eyes after so many miles of unending sand and spinifex. Looking at it from our camp, on a high bank above an estuary opening out into the large lake some five miles farther south, we could easily understand why Gregory called it a sea rather than a lake, for anything more like the low-lying arms of a sea, such as one sees in Southampton Water when the tide is out, it would be hard to imagine. Even the smell of seaweed and muddy ooze is not wanting, and to complete the picture, myriads of wild-fowl cover the sand-banks and the surface of the water. In the early morning, so dense is the crowd of shags, ducks, pelicans, snipe, and other birds, that to say that there was acre upon acre of wild-fowl would not be wide of the mark; but in spite of their abundance they are not easily shot, their very numbers ensuring the watchfulness of the flocks. Nevertheless we bagged more ducks than we could eat, and, with fish in abundance, had a most enjoyable time.

Large camps of blacks, perhaps two hundred in all, were dotted round the lake, and on our first arrival we had an escort of nearly a hundred yelling and excited blacks, mostly men and boys, for, though very ready to talk of their "womany," they were careful to keep

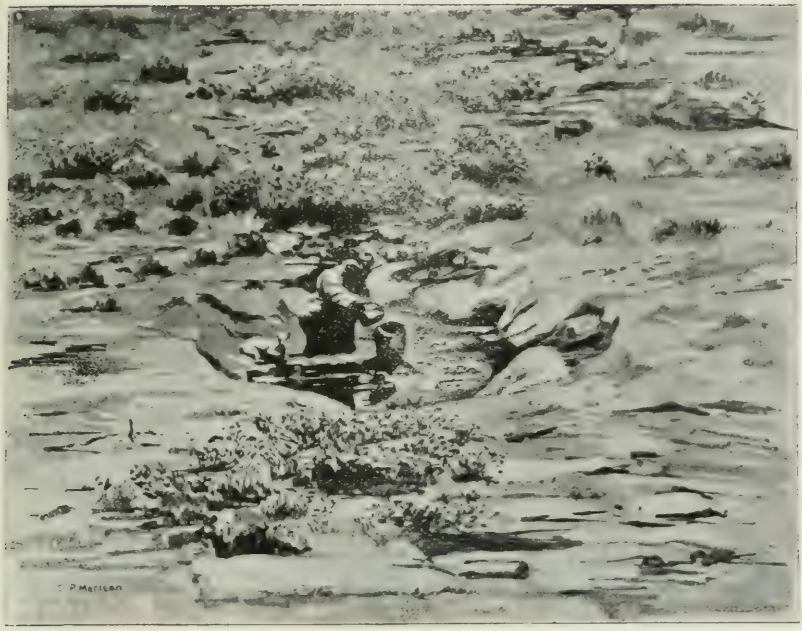
them in the background. They were peaceable enough, and I made them take one side of the water while we camped on the other, and won their hearts by shooting pelicans for them, though the ungrateful fellows took our boy Tiger from us and would have actually murdered poor Warri. Here we saw some of our former Jewish-looking acquaintances, who recognised us at once; one old man, whose son's eyes I had doctored with lotion, was greatly pleased, and told us, through Tiger, that the boy's eyes were all right again. We questioned them about Wells and his party, but they seemed to know little, though they had heard of the murder of a white man by a native down the Fitzroy—an occurrence of recent date. They also told me of some white men who died in a cave a long while ago, somewhere about Christmas creek. Hoping to find some interesting facts for students of ethnology, I asked the old man his name. He said he had not got one, which seems strange, so I christened him "Jacob," for the benefit of the next person who recognises in him the characteristic features of the Jewish people.

These Sturt natives are fine, well-built men for the most part. The abundance of game and fish no doubt accounts for their good condition. Fish, from what I could gather, is not a common article of food amongst them, for, having nothing in the shape of hooks or nets, they are able to catch fish only on rare occasions, when they find them up a creek in shallow water. Out of this they sweep them with a sort of dredge of branches, which they drag through the pools on to the banks, the water running back through the sticks and leaving the fish high and dry on the sand. They find also quantities of mussels, which, though very unsavoury to us, they greedily devour when baked in a heap of ashes.

After making a complete circuit of the lakes, Gregory in 1856 satisfied himself that there was no outlet for any overflow of water from the lakes. At the time of his visit they were dry, or nearly so, and doubtless had the appearance of being very shallow, so that after following a creek for some three hundred miles, which showed every sign of occasionally flooding to a breadth of four or five miles, he would naturally suppose that so great a volume of water as must at times flow into the lakes would more than fill them and cause a considerable overflow.

In spite of Gregory's statement to the contrary, I have heard it argued that some outlet must exist, as the only likely means of escape for the waters of the Sturt in flood-time. Now, in the first place, the lake is much deeper than one would suppose, for one naturally compares it with the dry salt lakes farther south, which seldom exceed three or four feet in depth. The estuary on which we camped was some fifteen feet deep, and the middle of the large lake was estimated by one of Mr. Buchanan's party to be twenty to thirty feet deep. Now the large lake, besides which there are three smaller ones, is reckoned to be seven miles in diameter by Gregory, and therefore can contain a large body of water.

In the second place, the Sturt below the junction of the Wolf is continually losing its waters, the creek, especially towards the west, throwing off arms and billabongs, which go to form swamps, lagoons, and clay-pans. So much water is wasted in this manner, that near the entrance into the lake the creek is of a most insignificant size,



HELENA SPRING.

AMONG THE SOUTHESK TABLELANDS.

VALLEY DESCENDING FROM GODFREY'S TANK.

STURT CREEK, BELOW ITS CONFLUENCE WITH THE WOLF.

especially compared to its great length. Now Mr. Stretch tells me that the Sturt runs its entire length about once in three years, and that water after heavy rain at the source takes eight days to reach his homestead (in latitude 19° 9′). Heavy rains had fallen at the head about one month before we got to the creek, and the water was still running. We therefore saw the lakes as full as they probably ever are, except in abnormal seasons.

Before reaching the lake, we passed several large clay-pans which had not been filled by the late rains, and the lake itself could evidently contain more water than it then held, and had done so in times past; so that it is pretty clear that the lake is large enough for the ordinary flood waters, and with the outlying clay-pans can accommodate the waters of an extraordinary flood.

It is interesting to read Gregory's impressions of the country beyond the lake, as he saw it from the top of Mount Wilson, close to which we passed.

"From the summit of the hill nothing was visible but one unbounded waste of sandy ridges and low rocky hills, which lay to the south-east of the hill. All was one impenetrable desert. . . . The vegetation on this part of the country was reduced to a few stunted gums, *hakea* bushes, and *Triodia* (spinifex), the whole extremely barren in appearance. . . . The remaining portion of the horizon was one even straight line: not a hill or break of any kind, and except the narrow line of the creek, was barren and worthless in the extreme, the red soil of the level portions of the surface being partially clothed with *Triodia* (spinifex) and a few small trees, or rather bushes, rendering the long straight ridges of fiery-red drifting sand more conspicuous."

So Gregory retraced his tracks up the Sturt, and when one remembers that he had horses, one can only say, "and wisely."

We left the lakes on April 20th, shaping a course to take us on the whole through the country mapped by Warburton, though I did not actually steer for any of his points or waters, knowing that doubts as to the accuracy of their position existed; and I may say here, though it is anticipating a little, that our course should have taken us right through the salt lakes marked by him close to the border, but no such lakes lay across our path, though in the same latitude as Lake White, and some seventeen miles to the east of the position assigned to it by Warburton, we passed close to a lake the general description of which would agree with that of Lake White—sand-hills and spinifex right up the edge of the lake, salt and dry, of course, and fringing the eastern shore a high tableland of sandstone. After striking this lake we turned west to the Stansmore range, and must have seen another lake in that latitude if it existed. Now, if I am right in saying that Warburton thought he was seventeen or eighteen miles farther west than he was in reality, this would account for his failure to connect with Gregory's traverse of 1856 at the Sturt lakes, and also for the failure of two parties to locate certain of his positions. The one was Mr. Buchanan's, who travelled a few days into the desert beyond the Salt Sea, and returned quite satisfied that a stock route between the Sturt and Oakover

was impracticable. Mr. Buchanan looked in vain for Lady Edith's lagoon, which is marked as only fifty miles from the lakes. The other party was that of Mr. Smith, who attempted to cross the desert to the Oakover, but returned after penetrating it only a short distance. Mr. Smith told me that he thought he had located "Bishop's Dell," and this he placed due south of the larger lake, instead of south-south-west as shown on Warburton's route.

Mr. Wells, too, eventually found Joanna springs some twenty miles east of Warburton's position, and therefore we may conclude that Warburton's work wants shifting bodily on the map some seventeen or twenty miles to the east. Considering the sufferings that he and his party went through, one can only marvel that Colonel Warburton was able to keep any sort of reckoning.

On leaving the lakes, we at once entered desert country, a belt of "boree" scrub intervening, but not into the sand-ridges until about latitude 20° 35′, when we took a turn to the south, leaving a prominent single hill, Mount Elphinstone, to the north of us. Beyond the lake we got water in a small gully running down a tableland, but after that our old methods of steering for smoke, surprising camps, and running down the natives had to be resorted to.

In the Stansmore ranges, in lat. 21° 30′, several good creeks take their rise, only to be engulfed in the greedy sand, though I fancy, from a line of large gums which I could follow with field-glasses for a great distance, that one at least must reach the lake which I take to be Lake White. Thus far the ridges were bad enough, but thence to Lake Macdonald, and beyond that, too, they surpassed any we had yet seen for height, frequency, and sterility; and Warburton was wise when he turned back in 1873, and made up farther north before attempting to cross. As usual, the difficulties of travel were intensified by the obstinacy with which these ridges hold to their east and west direction, causing us infinite labour in crossing the country dead against the grain. Mr. Breaden counted the ridges we crossed in one day's march of eight hours and found the number to be eighty-six. And this stage was a fair average specimen. As to the distance in an average day's march of eight hours, it was not more than twelve and a half to thirteen miles, though probably our actual mileage, reckoned up and down the switchback ridges, would be more than half as much again. In latitude 22° 19′ we got a change, black desert-oaks taking the place of the usual stunted gums, and one day's flat travelling. Here, too, we made more captures: amongst them a very small man, almost a dwarf, with most peculiar wall eyes, like a skye terrier, after whom we named the well that kept us occupied for two nights and a day in clearing it out. The next well we came to was in the Winnecke hills of Tietkens (1889), with the exception of one poor one, a mile and a half west of Mount Webb, a large, single flat-topped hill, about where Tietkens' Dover hills should be (latitude 22° 57′). Tietkens cannot have seen this large elevation, which I have named "Mount Webb," or he would certainly have named it, and not included it in the general name of Dover hills, as would seem to be the case from the map I have. Of the identity of the Winnecke hills

I am quite certain, as between them and a low range, the Davenport hills, we skirted the corner of Lake Macdonald. We pushed on without stopping at the well, the sand-ridges still continuing, and between them narrow flats of oaks. The ridges here were comparatively low, and had fair feed on them, but still they were high enough to prevent our obtaining more than one glimpse of the lake. Passing the corner of the lake, over samphire and salt-bush flats, and marching across the Davenport hills into the sand again, we found a native camp just on the edge of the ridges on the east slope of the hills. The water to which we were guided was a large rock-hole, with what we took at first to be a soak in the bottom: so we gave the horses half our remaining store of water and took a few hours' sleep before setting to work. At first we hoped that the hole would be a soak, but, alas, we were disappointed, and nothing remained but to dig out the sand, as usual, sinking our iron boxes ahead of us and bailing out the water. We started sinking at 7.30 A.M. on the 18th, and worked (with one and a half hours' interval) until 2 A.M. on the 19th, then again from 6.30 A.M. on the 19th until 5 P.M. of the same day, by which time we coaxed not quite ninety gallons out of the hole. Of this we gave the horses nine gallons apiece and the camels three apiece, and one camel three gallons extra, reserving about thirty gallons to go on with. The hole now had a most peculiar shape. At the mouth oval-shaped, some twenty-five feet long by twelve feet across, it narrowed at a depth from the surface of ten feet to an almost round hole some six feet in diameter, with smooth straight sides of sandstone coming together at the bottom in a point some twenty-five feet from the surface. By a rough calculation I made out its capacity to be four thousand gallons.

The next day, with the help of the buck who pointed out our course, we found a splendid rock-hole brimful, with more water than we could use in four days. How that nigger must have laughed to himself as he watched us slaving away the previous day! And this was one of the many occasions on which a fourth man would have greatly assisted us. For on our first journey, before poor Charlie Stansmore died, whilst three worked on the well, the remaining one and the boy could be hunting for more water.

In the native camp here we found barbed spears and a better class of implements generally. I suspect that the natives only make occasional desert trips away from the well-watered country over the border. Amongst other treasures we found a piece of glass bottle, evidently used for fining down and smoothing spears, etc., most carefully tied up in a grass-woven case which opened like an oyster, and was lined inside with feathers. In the same camp (near Mount Webb) we got a sporran formed of a pearl-oyster shell or large conch-shell, and one of the upper portions of a human skull, whether that of a white or black man I cannot say; a piece of the covering of a camel saddle was also in use as a sort of sack for carrying things in. From the last-mentioned rock-hole we kept a southerly course, until about the centre of what was formerly marked as the probable outline of Lake Amadeus on this side of the border; no lake however was to be seen, only sand-ridges. We now turned westwards, marching parallel with the Rawlinson and neighbouring ranges, though too far off to see them except

from one point, where we caught sight of a large and prominent block of apparently bare red sandstone standing up alone on the horizon. This should be Mount Skene from its bearing, and distant some forty miles from where we saw it. Soon we were to see our last smoke and make our last capture, for from the day of reaching the "deep rock-holes," latitude 24° 20′, longitude 127° 20′, we saw no more smokes, and but few natives or tracks. From a point three days east of these rock-holes to a point about an equal distance beyond them in a south-westerly direction, we encountered the most utterly barren and miserable country it was our lot to see—not a bite for camel or horses; no animal life; not even the usual spinifex rat, which vanished with the smokes; no birds, no natives, no tracks, no vegetation save the everlasting spinifex in a most decrepid state, and a few stunted gums or desert oaks standing solitary on the crests of the sand-ridges. Luckily this wretched wilderness soon came to an end, for a little south of the end of the Rawlinson range we were delighted to come once more into open country, the undulating gravelly desert, first crossed from west to east by Giles, and found by us, in 1896, to extend northwards to latitude 22° 40′. Steering due south-west for Woodhouse lagoon, we had splendid country for travelling over —undulating desert of gravel and spinifex, with occasional thick mulga scrubs. Here we saw but very few natives' tracks, and those which we followed took us nearly always to dry rock-holes.

About latitude 25° 30′ we sighted what I took to be a long low range of hills, by my reckoning the Sutherland range, but on nearer approach we found that they were only high sand-ridges. A line of salt lakes and samphire flats, running in a southerly direction, and consequently at right angles to the sand-ridges, leave their butt ends, as it were, standing up, and these ends and the ridges beyond have in the distance the appearance of a line of broken hills, and were at first mistaken by us for a range. On the margin of these small lakes we found the first really good feed for camels or horses we had met with since leaving the Sturt creek. Keeping on our south-west course up to latitude 26°, we came on a nice little soakage in the sandy bed of a fair-sized gum creek. This I took to be the Blyth, from its position, course, and size. Forrest, in '74, marked a tree on this creek, but this I was unable to find, and, indeed, it is possible that it has fallen or been burnt. But a sketch that I made of a remarkable chimney-like peak seen from the head of the creek was at once recognised by Sir John Forrest, and so there can be no doubt that it is the Blyth that we were on.

Forrest buried numerous articles at his camp on the creek, including a bottle containing letters, and I much regret that we were unable to recover such interesting relics. From the cliffs, in which the Blyth and other creeks head, I saw the same sand-ridges which we had skirted, and certainly from that distance one would say that a range existed. I have another reason for thinking that the northern part at least of the Sutherland range is merely sand-hills. Mr. Breaden, who was with Mr. Carr-Boyd on a prospecting trip from South Australia (along Forrest's '74 route), kept a diary, and from it I find that after passing Barlee springs they steered due west, so as to keep as near as possible along the parallel of 26°,

passing within a mile or two of the peak which I sketched, on the north side of it, and continuing west until within sixteen miles of Mount Allott. Six miles west of a creek which I take to be the Blyth, they found a fresh lagoon, in the midst of high sand-hills. Here they expected hourly to sight the Sutherland range, but saw no hills, with the exception of high sand-ridges, until they were eleven miles west of the lagoon, by which time they ought to have crossed the range as marked by Forrest. Here they turned a mile or two north to cross a narrow arm of a salt lake coming from the north-north-east (probably a continuation of the same lake crossed by us farther north—Lake Breaden), from which point they travelled some fifteen miles south-west towards Mount Allott, a line of low cliffs and broken sandstone hills following them on the north, standing above the sand-ridges. Now, it seems to me that here, where the range is marked running westwards, is the only genuine part of the Sutherland range.

On leaving the creek we steered for Woodhouse lagoon, and that day we had the first rain that we had experienced on either trip, and which enabled us to get on without carrying water for the horses, of which we had now lost one from internal complaints brought on by hardship. The lagoon we found to have but a few inches of water, whereas the August before it had had as many feet, at which time Alexander spring was dry as a bone, and in appearance like a common rock-hole in the bed of the gully, whereas now it was brimful of crystal-clear water. Small pools of water were lying about all over the rocks, so evidently the rain had been fairly heavy, but not heavy enough to run the creek below Alexander spring, which, I think, mainly supplies the lagoon.

On Mount Allott the pile of stones, re-erected by Mr. Hubbe, in command of a South Australian Government expedition on the search for a stock route (along Forrest's route as far as this point), had again been attacked by the niggers. I replaced the missing stones. A fair number of blacks must have been camped here shortly after our first visit, evidently to hold a coroborree, for between the Mount and Alexander spring I found a cleared place in the scrub, stones stuck up in the forks of the surrounding mulga trees, and a sort of altar of bushes, to and from which led numerous tracks. Hidden in these bushes, I found one of these peculiar long flat mulga boards, curved on the back, flat in front, about eight feet long and six inches wide, and tapering towards either end, with the face carved or burnt into rude patterns and diamond-shaped figures, and the whole smeared with fat and red ochre. I remember in Forrest's book he describes such a one found near the same place. We saw several longer and better carved ones near the Empress spring the previous year.

From the lagoon we steered a course a little south of west, intending to pass Lake Wells on the north and strike the Bonython creek, but on nearing the lake we found our progress barred by an unmarked arm which runs away in a northerly direction as far as the eye can see, in a chain of small lakes, swamps, and samphire flats, broken by sand-hills and ridges. This arm, the existence of which was, I believe, first noticed by Messrs. Rodgers and Parks, the prospectors of Lake Darlot,

joins Lake Wells about the centre of what is marked as Von Treuer plateau. This tableland does not extend nearly as far east as was originally supposed, and from the north side has not at all an imposing appearance. It is rather a curious fact that the tablelands of which Lyell Brown Bluff and Parson's Bluff are the prominent features, when seen from the north, appear a great deal more important than when seen from the south, being apparently a deal higher than the west end of the Von Treuer, as seen from the south; and I imagine that, if Mr. Wells had chosen the northern side of the lake to travel along, he would certainly have marked the high tableland as running round the southern shore. After several unsuccessful attempts at crossing, all ending in the hopeless bogging of horses and camels alike, we made for Mr. Wells's crossing, which we knew to be narrow and good, and here we got over with great ease, not having to carry a single pack. The lake here has a hard bottom within a few inches of the surface, and consequently the camels could not sink to any appreciable degree. We now followed the same route as Mr. Wells to the Bonython, which, though only a flat, shallow water-course, as he described it, has several good pools in it. From the Bonython we marched to the Erlistoun creek, striking it just below Mr. Wells's marked tree. The country between the two creeks is for the most part flat desert country and mulga thickets, with a coarse under-growth of grass. Before reaching the Erlistoun, we passed through the only auriferous country we had met with since leaving the neighbourhood of Hall's Creek; but having been some days without meat, we did not linger, but made at once for Lake Darlot, and thence by easy stages to Coolgardie, having travelled, during an absence of almost exactly a year, about three thousand miles, nearly half that distance being through hitherto unexplored country.

On looking at the large blank expanse on the map of West Australia before starting, I had almost persuaded myself that we should find at least a small belt of mixed country, similar to that which includes Lake Darlot and the outlying "finds" in the Mount Margaret district, mixed, in the sense that all round and between many of these far-out fields one finds patches of desert country, so frequent that, I believe, one could travel the complete circuit of the Lake Darlot field, say, within a radius of perhaps twenty miles, and be all the time in sand and spinifex. But now, after the best part of a twelvemonth spent in travelling, during which time we covered a distance of nearly three thousand miles (Lake Darlot being about eight hundred miles from Hall's Creek in a bee-line), surely, did any such mixed country exist, we must have chanced on some of it. Once past the longitude of about 122° 30′, the character of the country, as well as of the rocks, undergoes an entire change; and from there right away up to the old-established diggings of Kimberley it is the same dreary monotony of sand and sandstone. Coming back we fared no better, and I am forced to the melancholy conclusion that the greater part of the vast interior of this country is useless to man or beast; that a direct stock route between the Kimberley district in the north and the Murchison-Coolgardie fields in the south can by no possibility be found; and that all idea of any auriferous

connection between Kimberley and Coolgardie must be banished from our minds, though I consider it most likely that gold will be traced from Lake Way by the Ophthalmia range to the north-west goldfields.

Judging from what Sir John Forrest tells me, I should say too that gold may be found about Mount Moore, near Lake Augusta; and a small patch of auriferous country, in which no more than "colours" have been obtained, is known to exist in the Warburton ranges, which have been visited by one or two prospectors.

I may mention that ours was one of the few expeditions through the interior which was unaccompanied by Afghan camel-drivers, and that throughout both journeys we had only one sore back amongst the camels, in spite of the heavy loads they carried across country well calculated to knock both packs and backs to pieces.

In conclusion, I take this opportunity of putting on record my most deep feelings of thanks and gratitude to my companions for their untiring energy and help through all our journeyings. I verily believe that worse country, or, indeed, better country either, has never been travelled through by a more cheerful party, or by one the members of which were more in accord; and to the unanimity and ready co-operation that prevailed throughout the camp the successful issue of the expedition must in a large degree be ascribed.

I subjoin a few native words collected at various points of our route. It was very difficult to make sure that the interpretations were always correct, but by testing several natives I obtained, I believe, reliable results.

Empress Soak.

Fire or Smoke,	*Warru* or *Wallu*.	Arm,	*Menia*.
Wood,	*Tualpa*.	Hand,	*Murra*.
Nose,	*Wula* or *Ula*.	Hair,	*Kattya*.

Helena Spring.

Eagle-Hawk,	*Gunduru*.	Smoke, Fire, or Firewood,	*Warru*.
Gum-tree,	*Waaldi*.	Water,	*Gabbi*.
Sand,	*Nua*.		

Point Massie.

Water, *Yuï* or *Yurri*.

Gregory's Salt Sea.

Gregory's Salt Sea,	*Burro*.	Mussel,	*Bimbirri*.
Fresh Water,	*Nappa* or *Yuï*.	Whistling-Duck,	*Chibilu*.[2]
Salt Water,	*Murabba*.[1]	Pelican,	*Coya*.
Creek,	*Gilli*.	Moon,	*Yungun*.
Fire,	*Wallu* or *Warru*.	Star,	*Gigi*.
Fish,	*Yagu*.	Southern Cross,	*Wun-num*.

[1] Hunt's Slate well, near Lake Lefroy, which is sometimes salt, is called by the natives *Murabbi*.

[2] An imitation of the cry of the bird.

LIST OF POSITIONS.

Outward Journey.

	Lat.	Long.
Clay-pans, south of Doyle's or Cutmore's Well (July 21st . .	28° 35′	120° 57′.
Native Well on small creek (August 1st), . .	27° 40′	122° 54′.
Small Creek (August 6th), ...	27° 9′	123° 59′.
Empress Spring (August 10th), ...	26° 47′	124° 25′.
Woodhouse Lagoon (August 19th), . . .	26° 10′	124° 48′.
Native Well, dry (August 25th), ...	25° 15′	124° 48′.
Warri Well (August 29th), ...	24° 57′	125° 9′.
Family Well (September 17th), ...	22° 40′	125° 54′.
Native Well (September 29th), ...	21° 49′	126° 33′.
Helena Spring (October 5th), ...	21° 20′	126° 20′.
Soak, east of Point Massie (October 14th), . . .	20° 45′	126° 23′.
Godfrey's Tank (October 19th), ...	20° 15′	126° 25′.
Jew's Well (October 27th), ...	19° 41′	127° 17′.
Mount Bannerman (November 1st), . . .	19° 27′	127° 11′.
Mount Hawick (November 20th), ...	18° 53′	127° 3′.
Hall's Creek (December 4th), ...	18° 16′	127° 47′.

Latitude by Observation—Longitude by Account.

Return Journey.

	Lat.	Long.
Hall's Creek (December 4th, March 22nd), . .	18° 16′	127° 47′.
Denison Downs Homestead (April 1st–6th), . .	19° 9′	128° 13′.
Lagoon on Sturt Creek (April 11th), . . .	19° 45′	127° 39′.
Camp on Estuary above Salt Sea (April 15th), . .	20° 11′	127° 31′.
Camp (April 23rd), ...	20° 32′	128° 10′.
Camp (April 28th), ...	21° 4′	128° 33′.
Camp near mouth of Glen Wilson, Stansmore Ranges (May 2nd), ...	21° 25′	128° 20′.
Dwarf Well (May 7th), ...	22° 19′	128° 16′.
Native Well, one mile west of Mount Webb (May 12th),	22° 57′	128° 20′.
Native Well (May 16th), ...	23° 26′	128° 42′.
Large Rock-Hole (May 20th), ...	23° 44′	128° 52′.
Deep Rock-Holes (May 29th), ...	24° 20′	127° 20′.
Tree marked on Blyth Creek (June 11th), .	26° 0′	125° 22′.
Woodhouse Lagoon (June 17th), ...	26° 10′	124° 48′.
Camp (June 25th), ...	26° 20′	123° 23′.
Camp, two miles south-west of tree marked L. A. W. (on Erlistoun Creek), (July 12th), . . .	27° 36′	121° 46′.

CHAMAN.

By Major A. C. YATES, 2nd Baluchistan Battalion.

SOME little time ago the *Scottish Geographical Magazine* was good enough to insert a paper of mine on "Loralai." I hope that now it will be able to find space for this paper on "Chaman." As I write, the champions of the forward and backward policies are sounding their war-trumpets, and with the meeting of Parliament we are promised an animated discussion on this subject. There are those who contend that as India has made its frontier (by the Durand and other treaties), it should rule up to that frontier. The other school, again, teaches that the game is not worth the candle, and that India can afford neither troops nor money for enforcing its rule over a number of warlike tribes in their mountain strongholds. This latter principle, however, has not been made applicable to Baluchistan. On the Chaman side, at any rate, our rule is conterminous with our boundary.

Chaman is a name known to the Pathan and his fathers before him. It is not, as Loralai, the invention of the invader. "New Chaman" is, it is true, an innovation; but its origin lies in that "Chummun" (early Anglo-Indian) or "Chaman" (Hunterian spelling) which the annals of the first and second Afghan wars have made familiar to many readers. When the Government of India determined to construct the Kozhak[1] tunnel and secure a terminus down in the plain to the north-west—*i.e.* on the Kandahar side of the Khwája Amrán range—the site selected and secured for that terminus was called "New Chaman." The earliest mention I find in the limited library at my disposal here of Chaman is in Conolly's *Journey to Northern India* (vol. ii. p. 104), a record of travel in 1830. There he calls the place "Chokee," and to this day Old Chaman (as we call it) is known to the natives as "Chaman Chauki." (See Bellew's *From the Indus to the Tigris*, p. 116.) Havelock and Kennedy both mention the place in their memoirs of the first Afghan war. In fact, it was during both the Afghan wars a camping-ground and depôt of such importance that no historian or diarist could fail to mention it. In the second Afghan war a small fort was built there and garrisoned by two or three companies of infantry, with a couple of mountain guns and a small detachment of native cavalry. The sapper and miner camp, of which there are still traces, is a memento of the days (1879-80) when the cart-road over the Kozhak was being made. Round the fort in 1879-81 sprang up a small bazar. Its ruins are still there. Now, but for a few police and levies, the place is deserted.

Octroi, or import duty, is doubtless levied here on such of the imports from Afghanistan as do not pass through New Chaman, which lies seven miles north-west of the "Old." The Military Works Department still keeps in its charge the little four-roomed shanty that must have been the mess-house in the days of the second Afghan war. It comes in very

[1] *Zh* represents a sound in Pashtu exactly like that of *z* in *azure*.

useful as a *pied-à-terre* for those who go out from New Chaman for a day's *chikore* and *sisi* (two kinds of partridge) shooting in the Kozhak hills; but both it and the barracks that surround it surprise us in these days—with the evidences of permanent occupation all around us—by their diminutive simplicity. Still, both in the trying heat from June to August, and in the cutting cold from December to March, they must have been most welcome substitutes for tents. In these days an occasional regiment moving in relief, traders, caravans, nomads with their flocks and herds, and chance parties of emigrants or immigrants, are almost the only visitors to Old Chaman. A cart-road of gentle gradients now winds over the Kozhak between Chaman and Kilah Abdullah, but in August 1880 it was still a stiff climb for camels, and in earlier days than that guns had all to be drawn up and let down by ropes over the summit of the Kozhak pass. (Havelock, vol. i. pp. 302-3, and Le Mesurier, *Kandahar in* 1879, p. 218.)

New Chaman is a place with a future. If the "Old" has had some importance in the past as a base of operations during our two Afghan wars, the "New" is likely to be of far greater importance in the wars that India has yet to face. It is our outpost towards Kandahar and Herat, as Landi Kotal is towards Kabul and Balkh. The plant lies all ready here to extend the railway and telegraph to Kandahar. Although the Amir still tries to boycott Chaman (for he has never forgiven our occupying it as a railway terminus), trade must gather to it. The love of lucre will not be denied, not to mention the fascination and excitement of smuggling.[1] The Amir's prohibition is the veriest dead-letter. Not only do his subjects run contraband caravans by the hundred across the frontier, but his frontier police are, it is said, in league with them. Six annas per camel is the reputed price for shutting their eyes. Otherwise they open them and shoot, and the injured camel-owners bring their wounds sometimes to the Civil Dispensary here to be healed. This, at any rate, is better than being captured, for capture in the act of smuggling means death in Afghanistan. It is the export of grain that the Amir prohibits; but the high prices of the Quetta market tempt his subjects to evade his law. During the summer and autumn fruits come in from Kandahar in great quantities—droves and droves of donkeys laden with paniers full of grapes, peaches, melons, apples, pomegranates, etc. Most of these are sent by rail to Quetta, for consumption there, or in transit to India. Quantities of wool, too, come in. The custom-house at Chaman has a busy time. It stands at the corner of the bazar, just off the high road from Quetta to Kandahar. Bags of grain and bales of wool, groaning camels and Pathans, vociferous or phlegmatic (they are mostly in one or other of these conditions), are the main features of the scene.

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[1] Quite recently I saw hundreds of camel-loads of wool, grain, dried fruits, etc., after being weighed at the octroi-house, being carted to the goods depôt of the railway here for despatch to Quetta or India. Of the fruit trade with Kandahar I may mention that one Indian Rajah this summer sent a special agent to Kandahar to superintend the supply of fruit to him. All was carefully selected. Each peach cost him one rupee by the time it reached Chaman.

My first visit to New Chaman (the "Old" I had seen in 1880-81) was in June 1896. It was a simple and pleasant trip. An official of the North-Western Railway very kindly placed a trolly at my disposal, to carry my wife and myself down from Shelabágh through the tunnel to New Chaman. Shelabágh is a railway and military station near the summit of the Kozhak pass, and just at the east entrance of the tunnel (length about two and one-third miles), which pierces the range approximately from east to west, not, as might be supposed, from south to north. Spinwána is the fortified post at the west outlet of the tunnel. Shelabágh and Spinwána are garrisoned by two companies of the native regiment stationed at Pishin fort. Both places stand on the verge, or in the middle, of torrent-beds, but so far have escaped being swept away. On 15th July 1894 a very heavy storm[1] brought down silt and *débris* in such quantities from the Kozhak that the cutting near the west (Chaman) end of the tunnel was choked up, and it took a month to clear it out (Colonel Hanna, *Problem II.*, p. 73). Since then (as I noticed when walking over the pass in October last) a series of embankments have been constructed to protect the western entrance of the tunnel from floods, and prevent the line from being again blocked.

Trollying at thirty miles an hour is exhilarating anywhere. Trollying from Shelabágh to New Chaman has specialities of its own. At the very start you go straight into the darkness of the Kozhak tunnel, at a slow pace for the first half mile, for the line ascends slightly up to that point. The clang of a bell then tells you that the highest point of the ascent has been passed and the descent has begun. By this time the air is chilly, drops trickle from the roof, and even on the hottest summer's day you are glad of your wraps. The pace increases. The eastern (Shelabágh) entrance has disappeared from view, and far ahead a gleam of light reveals the western outlet. Nothing can be seen but the four rails stretching away in an ever-narrowing parallel up to that bright point. The pace gets still faster. You flash past the lights of a gang at work and into darkness again. Anyhow, that first spin down through the tunnel, at thirty miles or so an hour, in the black darkness, has a weird uncertainty of its own. After a few trips it wears away. Every day an inspection trolly makes the trip from Shelabágh to New Chaman to see that all is in good working order. A sub-platelayer is generally in charge, and he inspects the track and working gangs as he goes. I have done this trolly trip now seven or eight times, and always found men at work on the bridges or permanent way, or both. The line is open on both sides, and crossed by numerous paths used by travellers, caravans, etc. Moreover, camels, donkeys, sheep, and goats are grazing everywhere, and may at any moment walk on to the line round a corner. So you must keep a smart look-out if you are piloting the trolly. Thirty to thirty-five miles an hour is a safe pace enough on the straight, but going round a sharpish curve at that pace the trolly oscillates more than is pleasant. In the early days Pathans used to

[1] It was in fact a waterspout. A railway official who was on the spot at the time says it lasted half an hour, and blocked the line for two months.

lay logs or bricks on the line (after dark for choice), and now and again trollies were sent flying.

Let us now cross the Kozhak for a minute and take a brief glimpse at the line on the south or Indian side of that range. From Ruk, close to the Indus, the line runs across the desert to Sibi. This part of the line was laid very rapidly in the winter of 1879-80 to facilitate the transport of troops and *matériel* to Quetta and Kandahar. At Sibi the railway bifurcates and forms the Sind-Pishin and Mashkaf-Bolan lines, which again meet at Bostan, in the Pishin valley. These two branches have single lines only, and from Bostan onward to Gulistan, a flourishing village and police and revenue station at the east end of the Ghwázha pass, the line is also a single one. From Gulistan to New Chaman it is double. Between Kilah Abdullah, ten miles or so north of Gulistan, and New Chaman the gradient is a fairly steady 1 in 40, and this limits the traction power of the class of engine used to eight vehicles. When a certain number of goods-wagons have accumulated at Gulistan or Kilah Abdullah, a double train with two engines is made up. The double line is money well spent. When the tug of war comes some day, and we want to maintain an army at Kandahar or elsewhere, we shall be thankful for it.

Standing in the plain, down at New Chaman, and looking eastward, you see a group of hills running approximately north and south. Just opposite you are the Kozhak pass and tunnel, marked by a tall air-shaft on the summit; to the left front are the passes leading up to the Toba plateau, and, still farther to the left, the bed of the Kadanai river; to your right front are the Sanzal and Roghanai passes and the Khwája Amrán peak, and still more to the right, near the farthest spur the eye can see, the western outlet of the Ghwázha pass. This is a rough picture of the hills that approximately divide India from Afghanistan, as seen from New Chaman. Their average height is about 8000 feet above sea-level. I may say a few words here about the water-supply from the Toba-Kozhak-Khwája-Amrán hills. Many little springs naturally crop up here and there, high up and low down. The latter, assisted by the construction of *karezes*, irrigate all the cultivation, and supply Sanzal and Old and New Chaman with water. The amount of water depends greatly on the snowfall in the winter. The winter of 1896-97 was a severe one, and the water-supply from Toba this year (1897) has been unusually abundant. Last year there was a no less marked scarcity. In spring, after the snow and rains, grass and wild flowers spring up over hill and spur and plain. But their life is short; the blazing sun kills them. I had occasion in 1880 to do a long night march northward from Old Chaman along the foot of the Kozhak spurs. It was dark, but I could not fail to notice the number of little rills that we crossed. It was a hot night in August, and those little rills were welcome to all of us. The water of several of these has been since utilised to feed New Chaman, and to supply the needs of the railway and mobilisation camp. The water for domestic use comes from Old Chaman; that for cultivation from the Bogra and Surkai-Telerai *karezes*, six or seven miles east of the station. Formerly the water of the Málézai *karez* was brought

EIGHTY-EIGHTH PILLAR OF THE BALUCH-AFGHAN BOUNDARY.

A CORNER OF THE BAZAR, CHAMAN.

VIEW FROM EIGHTY-EIGHTH BOUNDARY PILLAR TOWARDS KANDAHAR.

down to New Chaman. Now it is all used up by an Achakzai Malik. The Achakzais are the dominant Pathan tribe round about here and in Toba and Pishin. It is, I think, evident that very many of the springs that issue from the western base of the Kozhak and Toba hills are due to the formation of that earthquake crack or trough which Capt. MacMahon described a year ago in his lecture on the Baluch-Afghan boundary before the Royal Geographical Society. Once the attention is drawn to the fact that this trough is a deliberate formation of Nature, you begin to notice its characteristics. You note the water oozing or springing out at many points, and the soil grassy or marshy. You note the frequent outcrop of barren patches of chocolate and slaty-blue earths. From New Chaman the eye can trace the trough from some miles north of the Bogra pass to the Roghanai pass, a distance of twenty miles or so. It passes to the east of the Khwája Amrán peak and so in a straight line onward (Capt. MacMahon tells us) to the vicinity of Mushki, seventy or eighty miles to the south. After the severe earthquake shock of 20th December 1892, the steel rails were found sharply twisted two feet or more out of the straight exactly at the spot where the earthquake trough crosses the railway close to Old Chaman.

From the western mouth of the Kozhak tunnel to New Chaman is about ten miles as the crow flies, and about eighteen by the railway. The line falls in these eighteen miles about 2300 feet, the gradient being about 1 in 40 almost the whole way. At first it winds south-westward along the spurs of the Kozhak through a succession of small tunnels. Sanzal station is passed at the south-west angle six or seven miles from the tunnel. From there the line trends to the north-west, and winds like a serpent in huge folds down the bare slopes to New Chaman, another eleven miles. The view from the Kozhak is a striking one. Not in many places is that blending of red sand, desert, and barren crag and hill to be seen. On a very clear day—and this atmosphere has at times a wonderful clearness—the Registan is seen stretching away in billowy dunes far to the westward, its surface broken only by peaks of dark rock and cliff studded here and there, islands in the sea of sand.

Across this desert lead westward several caravan routes from Nushki and Shoráwak to Sistan. These routes are all well known now, and one of them is being developed into what promises to be an important highway of trade between India and Persia. One needs to realise the extortion practised on traders in the Amir's territory to understand how valuable a trade-route safe from this extortion will be. During this September (1897) dealers with several hundred Turcoman, Herati, and other horses from North-East Persia and North-West Afghanistan passed through Chaman on their way to the Quetta horse show. According to the statements of some of these traders, the dues levied on them from Herat to Kandahar amounted to half the original cost of the horses. There appears to be no fixed rate. Each Government—Herat, Farah, Girishk, and Kandahar—extorts all it can get. Force is used if need be. *Daráz kun* ("Lay him out") is the order, if the trader is obdurate—and being "laid out" is evidently no very pleasant process. This year the Sistan route might have been used by all these Baluch horse-dealers, had

it not been for the absurdly rigorous quarantine enforced by Russian doctors and troops, with the consent of the Shah of Persia, along the Perso-Afghan frontier. The pretext was plague, and it served its purpose, although no single case of plague in Afghanistan has ever been reported. As far as I have ascertained, the Registan, north of the route *viâ* Káni and Galichah followed by Colonel Ridgeway's Mission in 1884, is practically trackless. From Kuh-i-Arbu, north of Chageh, there appears to be a route northward to the Helmund valley, and so on to Girishk. The Survey of India maps of thirteen or fourteen years ago show a route (distance about 100 miles) straight from Nushki across the Registan to Kandahar. The way it is put on the maps shows it to be a route not surveyed, but based on information probably obtained from nomad Baluchis or Brahuis.[1] One of the halting-places on the route is Konchi, the same name as that of a hill twenty miles west of New Chaman, and a familiar camping-place on the roads from Shoráwak and the Ghwázha pass, skirting the east edge of the Registan, to Kandahar. Shoráwak is a small district at the south-east corner of the Registan, consisting of some dozen villages, of which Samand Khan's village is the centre. It is ruled by an official appointed by the Amir of Afghanistan. The usual route from Shoráwak to Kandahar is *viâ* Isárgo, Spinakhula, and Skam-Kan to Konchai (distance sixty-four miles), where the road from Ghwázha to Kandahar is joined. The alternative route is across the Registan, the stages being said to be Zàla (eleven miles), Sárang (sixteen miles), and Konchai (twenty-five miles)—total distance fifty-two miles.[2] The two main routes from the Pishin valley over the Khwája-Amran range to Kandahar are known as the Ghwázha and Kozhak.

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[1] Compare also the routes shown in the maps illustrating Masson's *Travels in Baluchistan* (about 1840), vol. iv.

[2] I have quite lately obtained from some of the Achakzais about Chaman particulars of the following three routes from Shoráwak across the Registan to Kandahar. Of course, at most of the places mentioned, water is procurable from wells or rain-pools only. All three routes start from the "Khel" of Malik Samand in Shoráwak. Distances are approximately correct.

ROUTE I.

		MILES.
Shoráwak (Malik Samand's Khel)	to Isárgo,[1]	10
Isárgo	,, Sharbat Poti,	18
Sharbat Poti	,, Surkhat,	17
Surkhat	,, Hauz,	10
Hauz	,, Rahmán,[2]	18
Rahmán	,, Nawa-deh,[3]	15
Nawa-deh	,, Kandahar,	14
		102

ROUTE II.

Malik Samand's Khel	to Isárgo,	10
Isárgo	,, Zàla,	8
Zàla	,, Sárang,	10

[1] Spelt Hissargu in Masson's map.

[2] No doubt the same as Abdurrahman, two stages from Kandahar on main road.

[3] The same, perhaps, as Deh-i-nan, in Leach's map of 1882.

They meet near Mel or Saifullah. Both are frequently described by writers on the first and second Afghan wars. (*See* Le Mesurier's *Kandahar in* 1879, chap. xi.)

I first saw the Kozhak and Chaman in August 1880. At the end of that month General Robert Phayre's Division was concentrated at Chaman and Gátai ready to co-operate with Sir F. Roberts' force in the relief of Kandahar. As every one knows, Sir F. Roberts did the work unaided. Since those days there have been some changes. Old Chaman has passed away (except the ruins) and New Chaman has arisen, not to mention the tunnel and railway. A mile to the north-west of the fort of New Chaman the traveller passes the eighty-eighth pillar of the Baluch-Afghan boundary, demarcated by Capt. MacMahon and an Afghan Commission. If he looks to his right and left he can follow the line of white pillars eastward to the foot of the Toba hills, westward for two miles to some low sand-dunes, and then southward as far as the eye can see to Ghwázha. If he walks on three or four miles along the Kandahar road, in a north-westerly direction, he comes to the long, low Sar-Baldak hill, with a strong fort and defences, constructed by order of the Amir Abdurrahman Khan, at its southern end. All this is new, not only since 1880, but within the last two or three years. Indeed, the Amir's defences at Sar-Baldak are still in course of construction.

To the west and north-west from New Chaman stretches the red Registan to the horizon. In its foreground stand the dark mass of Konchai hill and the lighter (in bulk and colour) heights of Miyán and Pá-in Baldak. North-west, a succession of crags and peaks and spurs, ranged one behind the other, shut in the view towards Kandahar. In

			MILES.
Sárang	to Sahib Tira Kai,		11
Sahib Tira Kai	,, Bolak,		12
Bolak	,, Takhtapul,		17
Takhtapul	,, Mandi-hisár,		12
Mandi-hisár	,, Kandahar,		10
			90

These last three stages are on the Kandahar-Chaman high road.

ROUTE III.

Malik Samand's Khel	to Spinakhula,	10
Spinakhula	,, Arghoti,	15
Arghoti	,, Skám-kan,	16
Skám-kan	,, Konchai,[1]	12
Konchai	,, Robát,	10
Robát	,, Mél,[2]	11
		74

This route skirts the south and east edges of the Registan and latterly follows the Dori river. From Mél to Kandahar is about thirty-five miles, forming three well-known stages on the road to Kandahar in the second Afghan war.

[1] This is the hill twenty miles west of Chaman.

[2] On the highroad to Kandahar.

the foreground is the Takht hill,[1] and behind it again the peaks of Ashik-Sakai (scene of a love-legend, as the name shows) and Takht-i-pul, where Sir D. Stewart's cavalry had a little skirmish on the 4th January 1880. North and north-east from Sar-Baldak stretches a broad, open valley, intersected by the Kadanai river, past Murgha Chaman to distant peaks away in the Ghilzai country.

Though New Chaman is in itself, with its array of railway and telegraph plant and its mobilisation sidings and camp, the sign of our preparedness for war, it is at present a peaceful place enough. It is true that during the past summer and autumn the disloyalty of some few Baluch sirdars and the atrocities committed by a Baluch named Jaffir Khan (now, it is said, at Kabul with the Amir), coupled with the uncertainty engendered by the general revolt of the independent north-west frontier tribes, produced a feeling that it was necessary to be on the *qui vive*. It is not quite a settled neighbourhood. Acts of violence do occur. Contraband caravans are fired on. The Amir's subjects cross into our territory as often as they please.[2] Now and again some one in the bazar here is cut up. Thefts of Government or private property occur from time to time. The thieves are all from across the border, and escape whence they came. There is no extradition treaty between India and Afghanistan. It is a regrettable fact that when there was a little trouble with certain chiefs and tribesmen near Quetta, the home papers were made the victims of alarmist telegrams from India, and even from Quetta. It might have been supposed from those telegrams that the European population of Quetta, protected though it was by some 4000 troops, was in danger. One press correspondent talked of moving the women and children to Karachi. All that was needful was done by the Chief Commissioner and the General Officer in command. Insurrection was nipped in the bud, and such miscreants as Jaffir Khan and his gang had to take refuge at Kandahar. It chanced that, coincidently with these troubles near Quetta, an exodus of Achakzais, Kákars, etc., from Toba and Pishin into the Amir's territory began. The cause of this is no longer a secret, since the *Pioneer* (of 21st December 1897) has published an extract from the Chief Commissioner's report explaining it fully. No mention is made of the locust plague this summer, but I think that was the last straw. The Amir offered free food for the winter, and land, free of taxation at first, to all immigrants with their families. Some say that when the Amir's Famine Relief Fund closes the immigrants will all return—*if* they can get away.

A word or two now about the Civil Dispensary here, to which I have already alluded once or twice. These establishments, as is very well known, do very good work, and exercise a very salutary influence within and without our border. We may talk of Oriental ingratitude, but if a

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[1] Close to the Takht is the curious underground passage and well mentioned by Conolly (vol. ii. p. 103). It is a mile or two to the west of the Kandahar road. It is now known as "Bauli Khan Muhammed."

[2] No civilian or military employés of the Government of India are allowed to cross into the Amir's territory.

man owes life or limb to the skill of our medical officers, he will not forget it. It interests me sometimes to look in at the Dispensary and see the patients there. Some months back, I found a Pathan lying in a *kajáwah* (litter), smeared from head to foot with some extraordinary yellow paste or ointment. I found he had come from Girishk (150 miles off, on the Helmand) slung on a camel; and as the Chaman Dispensary could not take him in, and the railway would not, in his condition, accept him as a passenger, he was going on to Quetta by some similar form of conveyance. Though a mere skeleton, he had all his senses about him; and I could not but regret that the poor accommodation afforded by the Chaman Dispensary rendered this further journey of seventy-eight miles necessary.[1] A camel *kajáwah* is a very different thing from an ambulance cart. Another patient here, who has now gone the way of all flesh, was a Hazara who had been (so he said) a prisoner for eight months in a Kabul gaol. When at last set free, he had a horrible sore in his left shin, caused by the irons put on him. Nevertheless, he walked all the way from Kabul *viâ* Ghazni and Kandahar to Chaman. I found him one morning outside our barrack gates. He had just arrived, little better than a skeleton, and some of our sepoys were feeding him. He went into hospital, and for two months made a hard struggle for life, but had to give in at last. Our sepoys were very good to him. His shin was in a sad state—dead bone in it, and sloughing horribly. Yet he walked 400 miles with that leg.

One other instance of the powers of physical endurance of these dwellers in Afghanistan I will give. The two I have already mentioned were, one a Pathan, the other a Hazara (Mongol). The one I am about to tell of was a Tájik or Pársiwán, *i.e.* a man of Persian race and speech. It was in the hot weather of 1891—time about midnight—heat intense. I was bound for Ziárat, and lying awake in a railway carriage in the station at Jacobabad. Suddenly I heard a man talking Persian—a rare sound in Sind. Curiosity made me inquire who he was; I was told that he was a man from Afghanistan who had just completed the *hajj* (pilgrimage to Mecca), and was returning home. I saw he was a cripple. Next morning, after the train had passed Sibi, I asked him to come into my carriage and tell me his story. He had been, he said, in the fight with the Russians at Panjdeh,[2] and, after it, had made tracks with a band of comrades for Herat. The weather was terribly bad. His party endured much, and was evidently caught in the Arghawán pass in the blizzard which Sir P. Lumsden's party encountered in the Ausafid pass. He succumbed to the cold, and was left in the snow; but was afterwards rescued alive, and taken into Herat. His hands (minus some fingers) were preserved to him, but both his feet dropped off. After a time he was able to move, or be moved, to his home near Farah. One stump, however, would not heal. What made him undertake the *hajj* in that state, I cannot say. I only know that he did undertake it and

[1] There is but one small room for the patients. No women can be taken as in-patients.

[2] He probably belonged to the levies who were at Panjdeh, but took little or no part in the fight.

accomplished it, and that without feet[1] (he moved on his hands and knees), or any means of support except what he could gain by begging. As we know, good Mohammedans consider that their own weal and salvation are forwarded by aiding such pious efforts. I urged him to go to Quetta and get his unhealed stump operated on. However, cholera had just broken out on the Sind-Pishin line, and I think it probable that he went on from Bostan Junction straight to Chaman, and so back to his home at Farah. At that time the line was not open to traffic. It was opened on the 1st of January 1892.

It is, perhaps, not generally known that of late years a number of Pathans have been engaged in the camel business in Australia. They come back with a colonial twang, a vocabulary of Anglo-Saxon expletives, and sometimes a European wife. A few weeks ago, a Pathan who had made this good use of the years he passed in Australia, came through here from Kandahar escorting his European (German, I believe) wife to Quetta for medical treatment. She was veiled, and seemed to have adapted herself entirely to the ways of her husband's country. I hear also that she did not regret her matrimonial venture. It is, after all, no new thing for Mohammedans from India to bring home foreign wives. Some of the native regiments employed in the Chinese expedition of 1860, and in the Burmese campaign of 1885-89, brought back with them to their homes in India and on the north-west frontier Chinese and Burmese wives.

Prior to our occupation of New Chaman the permanent population of this neighbourhood must have been very small. Wherever water sufficient for cultivation was procurable, as from the Bogra, Surkai-Telerai, Málezai, Chaman Chauki, Sanzal, Roghanai, and other springs and streams, there one or two cultivators would settle permanently and till their orchards, gardens, and fields. All other cultivation is dependent on rain, and is in the hands of the nomads who winter here and summer on the Toba plateau (7000 to 8000 feet above sea-level). The permanent cultivators grow grapes, peaches, figs, apricots, melons of several kinds, cucumbers, Indian corn and millet. The nomads plough the soil[2] and sow the seed in December, January, and February, and by April the country round Chaman is a sea of green wheat and barley. The success of the crops depends firstly on the amount of snow and rain that falls from December to March, and secondly on the rain that may fall subsequently. This year (1897) no rain fell between the 22nd of April and the 7th of December. On the evening of the 22nd of April a heavy hailstorm, the hailstones being as large as good-sized marbles, took place. The crops ripened, and were harvested in June—the nomads coming down from Toba, whither they had moved at the beginning of May, specially for the work. They run up little arbours of boughs and live in these till the harvesting is done, and the crop (grain and straw)

[1] He would, of course, travel by road on a camel, pony, or donkey, and for the rest of the way by rail and steamboat.

[2] A dozen camel-ploughs may then be seen at work any day within a two-mile radius of Chaman. A man from behind guides the plough, while a boy leads the camels.

disposed of. It is all, or most of it, bought up by the local *banias* (Hindu tradesmen) and the detachment of native cavalry, and also by a few private persons for use in their own stables. The fruit crop this year was an entire failure owing to the locusts. These scourges made their first appearance about the 20th of May and stayed for a month, during which time they developed from the crawling to the winged stage of their existence, and ate every green thing (except the willows) in Chaman twice over. We fought them for a day or two and killed thousands and tens of thousands, and brought on ourselves thereby a double punishment. The dead thousands polluted the air horribly, and our flowers, vegetables, green fodder, and fruit-trees were none the less devoured to the last stalk—ay, even to the bark. Many of the young trees never recovered—just withered up and died. We first saw the baby locusts basking in millions on the sand-dunes three miles out of the station. We did not then know what they were, or realise the havoc they portended.[1] They were like little black hoppers. Two days later a great army of black and yellow crawlers swarmed across a broad deep ditch, despite the water we sent flowing down it to check them (for locusts swim capitally) and into our garden. They did not even confine themselves to the vegetation. They swarmed in hundreds up walls, doors, and windows. The wire gauze sheeting on the windows was then a very godsend, as it kept out the locusts and yet let in the air. This went on for four weeks, when the locusts shed their yellow and black shells, and came out in greyish-pink, and with wings. They then flew away, and, taking Quetta *en route*, stripped the tops of its trees. Millions of the crawlers also visited Toba and Pishin, and, as I have said before, in all probability caused in part the emigration of Achakzais and Kákars.

There is only one indigenous tree in this neighbourhood, and that is the gnarled, knotted, stunted growth which finds itself certainly most at home in the shaly detritus that fills the dry torrent beds of the Kozhak and Khwája-Amrán hills. Clay does not suit it at all. The Persian name for the tree is *khinjak*. It makes excellent firewood. The Persian sums up his four favourite firewoods in this little rhyme:—*Balg o bulūt, khinjak o tūt*. In Pashtu the tree is known as "*da shno wana*," and in scientific language, I believe, as *Pistachio Cabulica*. Raverty, in his Pashtu dictionary, makes it to be the mastic tree, but is, I think, mistaken. It is true that the tree exudes a clear white gum, but this gum has a strong turpentine odour, and is used, I have been told, for sticking things together, but never for chewing. It is to the fruit that the Afghan gives the term *shnē* (the tree being known as "the *shnē*-tree"), and this fruit is dried and pounded and eaten in milk. A Pathan whom I questioned said it was a species of pistachio—but I do not by any means accept his statement as gospel. The largest of these

[1] I noticed then, however, that they had already begun to feed on the small bushes growing among the sand-dunes. I noticed also many short, thin brittle stalks or tubes, composed of bits and ends of all sorts stuck together by some glutinous substance, standing in the sand. These, I am told, are the nuclei round which the locusts deposit their eggs. When I first reached Chaman in April the air was thick with clouds of full-grown locusts. These doubtless were the parents of the swarms which harried us in May and June.

trees that I have seen measured about 16 feet in girth—the average height being 15 to 20 feet. They apparently live to a considerable age, and their combination of decayed trunks and flourishing boughs rich in leaf and fruit indicates a strong vitality, especially in such a soil, and with little rain to nourish them.

Perhaps the past year (1897) has been an unusually dry one for Chaman. At any rate for fully seven months not one drop of rain fell. Our rainy season here closed with a remarkable hailstorm, and opened early in December with a still more remarkable waterspout. On the morning of the 11th of December the sky was heavy with clouds drifting from south to north, especially along the line of the Khwája-Amrán and Kozhak hills. Close to the Kozhak pass and tunnel a dense mass of cloud had sent down a waterspout, as a banian-tree sends down a root, to the more level slopes at the foot of the range. Where the waterspout emptied itself on the soil (six miles from where I was standing) it churned up a whirl of dust. For ten or fifteen minutes I watched clouds, waterspout, and dust drifting slowly northward.

The nomads about here keep up a number of small artificial ponds in which the rain-water collects. These supply them and their flocks and herds with water. During the winter the nomads are camped anywhere in the plain, in the sheltered spots at the foot of the hills where the water-springs are, and on the sand-dunes towards the Registan. They think nothing of having to fetch their water a mile or two—a task allotted to the women and the donkeys. The men, at any rate, appear to take good care of themselves and enjoy life; though during these heavy storms of snow and rain their tents of camel-hair cloth, though said to be waterproof, can hardly prove a perfect shelter. In cold weather the camp, or family, larder (goat's flesh and mutton) is kept day and night at the top of a high pole, or strung on a horizontal bar, supported at a height of 8 or 10 feet by two vertical poles. As they have fire-arms they also get a little sport. They surprise duck and teal in the early morning on their ponds. In the Toba streams in summer and autumn they net or catch with their hands numbers of good-sized fish, probably *mahsir*. In autumn, winter, and early spring sand-grouse pass Chaman in thousands, going towards the Panjab, Sind, and Mekran. Some grouse, notably the Imperial, stay for a time and feed and water here. I have shot four kinds here, the Imperial, the Common, the Pin-tailed, and the Coronated. The Pin-tailed sand-grouse is seen here in large flocks—say 500, more or less.

The outlying sand-dunes of the Registan (the prevailing wind here is from the WNW., that is, from right across the Registan) approach to within three miles of Chaman on its western side. On the lee side of every bush, shrub, plant, stone, boulder, and other obstacle the sand gathers in little rippled mounds, and these gatherings are, I conclude, the nucleus of the ultimate sand-dune, the sand-dune of the sand-desert that buries under its inexorable shroud all things, natural and artificial, that come in its path. When a British garrison was at Kandahar in 1880, a calculation was made as to how long it would be before the city itself, with its miles of fields and orchards, would be

WINTER CAMP AND LARDER OF ACHAKZAI NOMADS.

CAMEL PLOUGH.

PATHANS (ACHAKZAI) WITH BULLOCK PLOUGH.

buried beneath the Registan. The necessary lapse of time was expressed in hundreds or thousands of centuries; so it is not a matter with which we of the nineteenth century are concerned.

The mirage effects seen around Chaman, especially towards the Registan, are as striking as any I have ever seen. I never noticed them here till October, when the mornings were beginning to be fresh or even chilly. Since then I have seen these effects in many varieties of form. Now it is a pool of blue water some miles off, invisible to the eye in reality, standing up and facing me like a mirror; now a squat white boundary pillar, elongated into a tall white obelisk; now a conical hill far off in the Registan, thrown into a square shape, like a cathedral with chancel, tower, and nave; or the dunes themselves exaggerated tenfold and standing up like a precipice, and almost masking the peaks in their midst; now bushes magnified into trees, or a bit of low scarped bank transformed into a cliff, or a close-ranged row of columns; and lastly, away southward against the long, featureless horizon, sloping gently from the hills to the desert, shimmering waves of vapour that roll into countless fantastic shapes. The local superstition is that these strange appearances mark the sites of battlefields of days gone by.

Now that I have wandered into the region of mirage I think I had better come to a close. Sixty-seven years ago Conolly said all he had to say of Chaman in half a page. Since then it has seen our armies twice occupy Kandahar, and twice retire from it. The next time British troops occupy Kandahar they will probably stay there, and the railway and telegraph plant now parked here will then be laid out in lines, and carry trains and messages to some new and more advanced frontier outpost. Loralai, perhaps, will soon have little but a past. Chaman, I feel sure, has a future.[1]

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

New Members.

At a meeting of Council on Feb. 23rd, the following gentlemen were elected :—

Ainslie, Chas. A.	Taylor, John.
Blair, Patrick.	Waterston, John W.
Callan, Rev. Hugh, M.A.	Watson, J. Graham.
Reynolds, Major F. R., R.E.	

Ordinary Diplomas of Fellowship were conferred on Mrs. Fanny B. Workman, W. S. Bruce, W. Coldstream, Sir James S. Hay, Governor of Barbados, and Wm. Lindsay.

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[1] The rainfall at Chaman, from 1st January to 31st December 1897, was 2·9 inches. The heaviest rain fell on the 9th and 10th of January, the 7th of February, and the 10th of December.

The highest shade temperature was 107° on July 29th, and the lowest 9° on May 16th.

The octroi and import receipts for the year were about Rs. 30,000 (£2000).

There are papers on Chaman and its natural history, especially birds, in *Stray Feathers*, vol. ix. pp. 212 and 449.

Lectures delivered in February.

On Wednesday, Feb. 16th, the Hon. David W. Carnegie addressed the Society in Edinburgh on his "Explorations in Western Australia." Sheriff Mackay presided.

The following evening Mr. Carnegie lectured to the Glasgow Branch. Sir J. N. Cuthbertson took the chair.

At Aberdeen a meeting was held on Feb. 18th to hear Mr. Carnegie, Prof. J. Dove Wilson presiding; and on the 22nd, the lecture was delivered to the Dundee Branch, Mr. I. J. Weinberg presiding.

Lectures in March.

Two meetings will be held in Edinburgh during the coming month. Dr. James A. Greig will, on March 10th, describe a "Journey overland from Kirin, in Manchuria, to Moscow"; and towards the end of the month Mr. Borchgrevink will give particulars of the plan of his expedition to the Antarctic regions.

The Rev. Hugh Callan will address the Glasgow Branch on March 1st, his subject being "Lands and Peoples of the Balkans." Mr. Borchgrevink will visit Glasgow.

The explorer will also lecture to the Aberdeen and Dundee Branches.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

The Natives of Eastern Formosa.—The wild tribes that inhabit the mountains of the eastern sea-board of Formosa have been mentioned more than once in these pages, as presenting many problems for the ethnologist to solve. In the *Hansei Zasshi*, a magazine published in English at Tokyo, Mr. R. Torii, who visited the country in 1896, gives some fresh details of their customs and geographical distribution. He divides the natives into barbarians of the mountain and of the plain, the former comprising three tribes, the Yugeiban, the Iwatan, and the Ami. The Yugeiban, or Tattoo tribe, is a name given them by Mr. Torii; this people is usually called the Northern tribe, or the Head-hunters, as they are much addicted to collecting human skulls. They occupy the country in the neighbourhood of Saw-o in the north, and are distinguished from their neighbours, the Iwatan, by a taller stature and more slender figures, and a much darker complexion. They have straight hair, large eyes and long noses, the Roman type being common among the men, while the women have hook-shaped noses. Both men and women extract the two upper front teeth, and tattoo the face, each village having its peculiar design. On marriage a special mark is tattooed on the woman's face, extending from the ear to the corner of the mouth.

The territory of the Iwatan extends from Mount Morrison as a centre, northwards to the Tattoo villages, and southwards to the Paiwan country. Like the Tattoo tribes, they assert that their forefathers lived in the west, but they do not recognise any affinity with those tribes, and do not tattoo themselves. They have, however, in common the practice of extracting the upper front teeth. In stature they are the smallest of East Formosan natives, and are further distinguished by

short legs, curved backwards. Their faces are flat and broad, with bright eyes, wide nostrils, prominent cheek-bones, and arched eyebrows.

The natives of the plain Mr. Torii divides into five groups—the Ami, Pilam, Chipun, Pepo, and Kalewan. The Ami extend over a great extent of country, and in general possess similar characteristics, whether they live up in the north in the Shukoran valley, or near Pilam in the south. They are somewhat spare, have stout and rather long feet, yellowish skin, broad forehead, and prominent cheek-bones and jaws. The type, however, is to some extent modified in the north, and the Lam-si-hoang, who live in the plains, are agriculturists, and have a knowledge of the principles of irrigation. They cultivate the bread-fruit tree, which is not indigenous in Formosa, and may have been introduced by their forefathers, who, they say, came to the island in canoes. The Ami of the northern sea-coast, on the other hand, relate that in ages past water covered the plains, and that the man and woman from whom they are descended lived in a high mountain, from which they came down when the water receded from the lowlands. The Ami used only stone implements till the arrival of two men named Tanya and Kusha, who instructed them in agriculture, and taught them to keep off from their crops with spears and swords the deer and wild hogs, then very numerous on the island. During the last twenty years they have been furnished with agricultural implements by the Chinese.

The Pilam tribe, dwelling on the plain of the same name, are a little taller than the neighbouring mountain savages. Their most striking characteristic is the prominence of the forehead, cheek-bones, and jaws. Like the Southern Ami and the Chipun, they wear their hair hanging down over their foreheads, and down to their shoulders behind, a fashion common also to a tribe in northern Luzon. They tan leather and make it into clothes ; they feed cattle, buffaloes, pigs, etc., and till the ground with Chinese implements. In every village is a large house called the *Parangan*, where important public affairs are discussed. In their physique and customs, they have much in common with the aborigines of the Philippines, and their language seems to belong to the same family. As regards their affinity with other Formosan tribes, they have two traditions, one connecting them with the Chipun, the other with the Ami. Their striking resemblance to the Chipun supports the former tradition. This people is the most civilised of all East Formosan tribes. They are skilful carvers, like the Pilam, and are also adroit silversmiths.

The Pepo and the Kalewan are immigrants from the west. Their customs have been modified by Chinese influence, and the Pepo have completely forgotten their original language.

The Climate of Manila.—A series of observations for the years 1880-95 have been collected at the observatory of the capital of the Philippines, which lies in 14° 34′ N. lat. and 127° 11′ E. long., at a height of forty-six feet above sea-level. The coldest month is January, with a mean for the period of 76·8° F., while February and December are very little warmer. It is remarkable that the greatest heat occurs as early as May (the mean is 83·5°). The yearly mean range is very small, being only 6·7°. The mean temperature for the year is 80°. Every month the thermometer rises above 86°, and readings above 95° have been recorded in the months February to July. The absolutely highest temperature observed was 100°, in May. The lowest reading was above 60° (60·1° in January), while during the months May to October the thermometer never falls below 68°.

The figures for cloudiness and rainfall show that there is a well-pronounced yearly period, with a minimum in winter and a maximum in summer. From

February to April there is a slight fall, averaging 0·5 to 1·2 in., whereas from July to September the record amounts to from 13·4 to 15·3 inches. Probably the displacement of the heat maximum to May is connected with this distribution of the rainfall. The rainfall has been recorded since 1865, and the means for the seasons during the thirty years' period are :—winter, 3·82 ; spring, 6 ; summer, 38·2 ; autumn, 27·6 ; and 75·6 inches for the year. Thus ten times as much falls in summer as in winter. The amount in dry and wet years differs considerably ; in 1867 it was 121 inches and in 1885 only 35·6. In the former year 61·4 inches fell in the month of September alone. On the other hand, in winter, months with no precipitation are not uncommon ; during the thirty years thirty dry months were recorded.

From October to March the dry north-east monsoon prevails, while from May to September the south-west monsoon blows. The wind attains its greatest strength in September, while December is the quietest month of the year.—*Geographische Zeitschrift*, October.

AFRICA.

Irrigation Works in Egypt.—Sir W. E. Garstin's report on the Irrigation Department for 1896 contains much interesting information. The Barrage, by which name two dams, each of sixty-one arches, across the Rosetta and Damietta branches of the Nile, are denoted, has frequently been the subject of discussion among engineers, and in 1896, as remarked on p. 205 of last volume, was found to require attention. Vertical holes 5 inches in diameter and lined with steel tubing were sunk in the piers, and in fourteen cases revealed the existence of cavities varying in depth from 10 to 92 inches. These cavities were filled up with cement, and it is intended to test all the piers in the same manner. Though the state of the piers, as thus disclosed, seems somewhat startling, Sir W. Garstin holds that there is no serious reason for anxiety regarding the Barrage as long as the up and down stream aprons constructed by Colonel Western remain sound. If, however, the up-stream floor were to give way, it is very unlikely that the structure would bear the pressure when the arches are closed to hold back the water. Should the cement prove successful in strengthening the structure, it will be applied. But the most efficient way to render the Barrage safe would be to build a supplementary dam farther down stream which would hold up water to, say, two to two and a half mètres, and reduce the possible difference on the Barrage itself to less than two mètres. Probably such a work on the Rosetta branch would not cost more than £200,000, and if funds should be available, it will be seriously considered.

The storage of water by means of the Barrage has caused the cotton crop to be almost doubled, and increased other crops considerably ; large areas have been reclaimed, and the delivery of water through high-level canals has saved the labour of raising it on to the fields, and, by enormously diminishing the quantity of silt, has enabled the Government to maintain the canals by contract labour instead of forced. The growth of sugar in Upper and Middle Egypt has been more than doubled since 1883, and could be much further increased were a larger supply of water available. Drainage works have been greatly extended, with much benefit to the country and people.

An eccentricity in the behaviour of the Nile, remarkable because so uncommon, occurred between Nov. 22nd and 28th, when the river rose nearly 29 inches at Aswân, where it usually falls about 20 inches at that period. Consequently water began to flow into the Upper Egypt basins, and a quantity of seed, which had just been sown, was lost.—*The Times*, Dec. 28th.

The Anglo-Abyssinian Treaty.—The text of the treaty signed by the Emperor Menelik and Mr. Rennell Rodd, on May 14th, was published on February 10th. The definition of the boundary of British Somaliland, contained in an annexed note, is of most interest geographically. The boundary starts from the shore of the Red Sea opposite the wells of Hadu, as agreed between Great Britain and France in 1888, and passes along the caravan road through Abassuen to Mt. Samadu ; then past Mt. Sau and Mt. Egu to Moga Medir. From Moga Medir it follows a straight course to Eylinta Kaddo and Arran Arrhe in long. 44° E. and lat. 9° N., and proceeds, again in a direct line, as far as 47° E. long. and 8° N. lat., where it joins the Anglo-Italian boundary, which it follows to the coast. It is stipulated in the treaty that the caravan road between Zeila and Harrar through Gildessa shall remain open to the commerce of both nations, that Great Britain and her colonies shall enjoy every advantage in respect of import duties and local taxation which may be granted to the subjects of other nations, and that all material destined exclusively for the service of the Ethiopian State shall be allowed to pass free of duty through the port of Zeila, on application by the Emperor.—*The Times*, Feb. 11th.

Geology at the Cape of Good Hope.—The Geological Commission of the Cape of Good Hope has issued its first Annual Report. Under the direction of Professor Corstorphine, Mr. Rogers and Mr. Schwarz have mapped a considerable portion of the Cape, Stellenbosch, Malmesbury, Paarl, Tulbagh, Ceres, Worcester, Caledon, and Beaufort West districts. The 800 map, as it is called, of the Surveyor-General's department (800 Cape roods to the inch, or about half an inch to a mile) was taken as far as practicable for the topographical basis. Its main defect from a geologist's point of view is the absence of contours and the scarcity of individual heights.

The existence of coal and other mineral products has constantly come under the consideration of the staff. The belief that seams of coal lie under the Karoo has taken a firm hold of the minds of many people, but the probability of finding coal in paying quantities is very slight. Borings executed by Mr. E. J. Dunn, formerly Government geologist, failed to reveal any deposits, and Mr. Corstorphine has seen nothing but very thin "leaders." When the bulk of the Western Karoo beds have been mapped, it will be possible to decide definitely on the occurrence of coal.

The question of obtaining a water supply by means of deep borings was also brought before the Commission. Much good work has been done by the Inspector of Water Drills in securing fair supplies of water by shallow holes, but the prospects for artesian wells cannot be estimated until more is known of the structure of the country.

Professor Corstorphine gives a few notes on the Cango cave excavated in a mass of dolomitic limestone on the right bank of the Dongka Gat, a small stream flowing south from the Zwarte Bergen into the Grobelaar river.

AMERICA.

The Weather of Klondike.—During his stay in 1880 and 1881 at a fur-trading station of the Alaska Commercial Company, then standing where Dawson City is now situated, Mr. L. N. M'Questen kept a record of the temperature. The Yukon froze over on the night of Nov. 2nd, 1880, and on the 14th of May the ice first began to move, but stopped after running an hour. On the 17th it began to run again, and was nearly gone by the 20th. The traders say that it breaks first on the Upper Yukon, and that the general movement proceeds downwards to the delta, which is not clear till several days later. Between the Yukon mouth and

St. Michael the ice breaks away from the coast at uncertain dates—any time between May 31st and July 1st—and the flotilla of fur-laden barges often reaches St. Michael before vessels can pass the barrier of pack-ice off shore. From Mr. M'Questen's summary of temperatures it appears that from October the thermometer fell steadily, reaching a minimum of −67° F. on Dec. 20. The highest mean for that month, at noon, was −29°·3, and in January −5°·4 at 6 P.M.; but probably January is not usually the warmer month. In this month also occurred a singular and prolonged upward movement of the temperature, which was probably abnormal. During February there was another period of intense cold, while in March the effect of the returning sun became strikingly evident. The greatest range of temperature, 88°, occurred in this month. The complete record of daily observations from Sept. 4th, 1880, to May 23rd, 1881, is given by Mr. Nelson, of the U.S. Biological Survey, in the *National Geographic Magazine* for Nov. 1897.

The Origin of the Loess on the Mississippi Valley.—Professor T. C. Chamberlin propounds in *The Journal of Geology* a theory to account for the distribution of loess in the Mississippi basin. It is found in some of the secondary valleys, as the Illinois and Wabash, as well as along the Mississippi and Missouri. It is coarsest and most typical in the bluffs bordering the rivers, and gradually thins off as the distance from the stream increases; sometimes it extends up to the watershed. Accordingly, the deposition of loess seems to be in some way connected with the rivers. Another significant feature is the distribution of this deposit along the border of the former ice-sheet at the stage now known as the Iowan. Here again the loess is thickest and coarsest near the ice limit, and thins away with increasing distance, as in the case of the river valleys. It has even been affirmed by several independent observers that the loess graduates into glacial clays and till, a relationship further tending to confirm its association with glacial action. Yet there are many objections to the hypothesis that loess is a product of glacio-fluvial action. The deposit has a vertical range of not much less than 1000 feet, and seems to have a special fondness for summits. Nor does the limit of the loess appear to be strictly topographic. It is difficult to bring its border into strict accord with a horizontal plain as required by the lacustrine and marine forms of the hypothesis, or into a consistent gradient as demanded by the fluvial phase. The abundance of land shells found in it is also hard to explain.

To harmonise these conflicting facts, Professor Chamberlin supposes that the silty waters from the margin of the ice-fields built up their sediments on broad flats, and that at periodical floods they extended more widely over the plains, leaving on their retreat extensive silt-covered tracts exposed to the action of the wind, which would sweep the loess, when dried, over the adjoining lands and lodge it among the vegetation. Thus the presence of land molluscs in the upland æolian loess is explained, while their presence in the lowland loess mingled with aqueous shells is equally easy to account for; the shells may have been washed down, and the molluscs might invade the lowlands in the intervals between the floods.

Richthofen's theory of the distribution of loess in China is that the dust is blown from the arid plateaus of Central Asia on to the more fertile plains of China, where it is carried away by streams and re-deposited in fluvial or lacustrine form. His theory may be called æolio-fluvial, while Professor Chamberlin's may be termed fluvio-æolian.

Clipperton Island.—The Mexican Government has lately turned its attention to those islands lying off the coast of the Republic which have been allowed to fall into the hands of foreigners. In 1896 the Revilla Gigedo group was inspected (see

vol. xiii. p. 208), and quite recently the gunboat *Democrata*, under the command of Captain Genesta, was despatched to Clipperton island, which lies in lat. 10° 17′ N. and long. 109° 10′ E. The island is 3½ miles long by 2½ broad. Its centre is occupied by a large lagoon, in a basin of volcanic rock, in some places extending to within a hundred yards of the sea. The water of the lagoon is fresh but hardly drinkable. There is no island in it, as shown on existing plans. Rain, however, is almost always falling, and can be stored in reservoirs. The shores of the island are steep, rendering landing a difficult matter, and only possible in calm weather. Fish are abundant in the surrounding waters, and sharks extraordinarily numerous, as also birds, which produce the guano that constitutes the only wealth of the island. This product is exploited by the Oceanic Phosphate Company of San Francisco. The agent of the company, Mr. Th. Gosmann, at once complied with the request of Captain Genesta to haul down the United States flag.—*The Mexican Herald*, Jan. 13th.

A Port for Bolivia.—The Republic has long been desirous of finding an outlet by which it may be brought into direct contact with the trade of the world, and at one time there were reports that, on the one side, a port had been ceded to it by Chile, and a strip of territory on the Paraguay river, on the other side, by the Argentine Republic. These reports proved incorrect, and Bolivia still remains enclosed on all sides. Sr. Guido Boggiani exposes the difficulties of the situation in the *Memorie della Soc. Geogr. Italiana*, vol. vii. part 1. His article is to a large extent polemical, but some facts of geographical interest may be gathered from it. In 1867, under the presidency of Malarejo, whom Sr. Boggiani characterises as an unscrupulous tyrant, a treaty was negotiated with Brazil, by which it was at first supposed that great benefit would accrue to Bolivia. Starting from the mouth of the emissary of the Bahia Negra, which enters the Rio Paraguay at about lat. 20° S., the boundary runs along the central line of the channel up to the Bahia Negra, an immense swamp, into which, at the north or north-west pours the Rio Otuquis, so that the eastern bank of the emissary is Brazilian territory, while the western bank belongs to Bolivia. The frontier then, running down the middle of the Bahia Negra, passes behind the Sierra dos Dourados or de San Fernando to the vicinity of Corumba, crosses the neighbouring lagoon of Caceres, and runs parallel to, but at some distance from, the Rio Paraguay, intersects the large lagoons of Mandiore, Gayva, and Uberaba, and, avoiding all the navigable affluents of the Rio Paraguay, enters the basin of the Amazons and joins the Rio Guapore at its intersection with the fourteenth parallel of south latitude. All these lagoons are connected with the Paraguay by channels of limited navigability, and, with the exception of the emissary of the Bahia Negra, these channels join the river where both banks belong to Brazil, and the navigation is restricted by treaties to the Brazilian flag. The only Bolivian port in more or less direct communication with the river is Puerto Suarez or Piedra Blanca, on the lagoon of Caceres, and in spite of its bad situation and the cost of transport by mules or ox-carts to Santa Cruz, the merchandise passing through this port has considerably increased of late.

In 1885 Miguel Suarez Arana, assisted by the Bolivian Government, undertook to establish a port on the Paraguay near the outlet of the Bahia Negra, on what he represented to be undisputed Bolivian territory, but the enterprise was crushed by the action of the Paraguayan Government. Another popular scheme is the acquirement of Puerto Pacheco, which, however, the Paraguayans refuse to part with, and an attempt to negotiate an exchange with Brazil for Tamarinero met with no better success. The difficulty of finding an outlet to the ocean

has, therefore, still to be solved, and, though Sr. Boggiani states that he has devised a perfectly practicable and satisfactory solution, he does not let us know what it is.

It is reported that Sr. Diez de Medina has recently obtained for his country the right of occupying a strip of ground on the southern shore of the lagoon of Caceres, extending to the point of Tamarinero. Here Bolivia will be able to establish a custom-house, and enjoy easy communication with the Paraguay by the channel that drains the lagoon.

OCEANS.

The North-East Pacific Ocean.—Herr A. Lindenkohl has contributed an article to the December number of *Petermanns Mitt.* on the specific gravity of the water in the north-eastern part of the ocean in its relation to temperature and currents. Beginning at the extreme north, he first notices that the water in the eastern part of Bering Sea is considerably fresher than in the western part, doubtless in consequence of the discharge of rivers on the American side, particularly the Yukon and Kuskokwim. Much greater is the difference in salinity in the northern and southern parts of the sea, probably caused by the free influx of heat and salt from the open Pacific into the southern portion, while the northern part is connected with the Arctic Ocean by a strait only 50 miles broad and 18 fathoms deep. The northern part above 57° N. lat. is closed for nearly eight months by an ice-barrier. To the west of the St. Matthew and St. Lawrence islands the ice breaks up sooner than on the eastern side, either because the greater depth allows warm currents to enter more freely, or that the greater absorption of salt on the congelation of the heavier water causes the ice to melt at a lower temperature. The mean surface temperature in summer of the south-western deeper part of Bering Sea was found by Dall to be 45·1° F.; along a line from Cape Thaddeus past the Pribilof Islands to the Alaska peninsula over moderate depths, 42·1° F.; and on the shallows and in the bays, 50·5° to 54°. The water of higher temperature, having a smaller specific gravity, can only proceed from rivers, for Dall has shown that no warm current from the Pacific is to be found on the surface of Bering Sea.

The observations of the *Albatross* in the southern part of the sea show a constant increase of salinity with the depth, due to a continual dilution of the water from the surface; and with this the observations of Makarof and Nordenskiöld are in harmony. In all the deep parts of the sea is found a temperature minimum at a certain distance below the surface. In the north it occurs at a small depth, at about 15 fathoms, with temperatures down to 29·5° F., the ice in winter preventing the penetration of cold. In the southern part of the sea it was found during the cruise of the *Albatross* that the temperature fell from 46° at the surface to a minimum of 37° at a depth of 80 fathoms, below which it rose to a maximum of 38·3° at 224, and then gradually decreased to 34·9° at 1998 fathoms, on the sea bottom. From this distribution of temperature it may be inferred that the winter cold descends as far as 224 fathoms, and that no marked difference exists at lower depths between the summer and winter temperatures.

The statement made above that the high specific gravity and temperature in the southern part of Bering Sea is due to an influx of salt and heat from the Pacific Ocean seems at first opposed to the repeated observations of Dall that no warm Pacific current, no branch of the Kuro Shiwo, enters the sea. When warm saline water comes in contact with colder water of equal weight, an exchange of salt and heat takes place, with the result that the cold water remains on the surface while a part of the warm water sinks, its specific weight being more increased by the loss of heat than diminished by the loss of salt. When the cold

stream is continually reinforced, as where the Kamchatka meets the Kuro Shiwo, the warm water cannot advance on the surface beyond a certain latitude, about 40° or 41°, but continues its course, constantly sinking, beneath the surface, so that the last traces of the Kuro Shiwo are recognisable in the high salinity of the deep waters of the Bering Sea.

Makarof in the year 1887 made observations on density and temperature in the Sea of Okhotsk which corrected many current errors. Along the axis of the Kurile islands lies a temperature so marked that in foggy weather skippers might be warned of their approach to the islands by the fall of surface temperature. Von Schrenck's explanation is that the cold currents flowing along the coasts of Kamchatka southwards unite at Cape Lopatka and continue their course past the Kuriles to Japan. But Makarof found the temperature lower among the islands than off the coast of Kamchatka, reaching a minimum half-way between Kamchatka and Japan. He ascribed it to the ebb and flood that set in twice daily with an average height of forty inches and an increased velocity of four knots. In the neighbourhood of the Kuriles the *Tuscarora* found a temperature of 35·2° at a depth of ten fathoms, which is not met with elsewhere above 1000 fathoms. Not less cold is the water below the surface of the Sea of Okhotsk. Now, the ebb and flood, in forcing their way through the narrow straits, may bring about a mingling of the surface water with that of the deeper layers and thus cause the surface water among the islands to be colder, and at the same time heavier, than in the ocean or the sea, while considerable masses of water are forced up from the depths in the neighbourhood of the islands.

After the Kuro Shiwo, flowing along the coast of Japan, has reached Cape Inuboge, it turns towards the north-east, but does not, according to Makarof, pass the fortieth parallel. Probably this opinion is founded on an examination of the isotherms, and may need some modification. Krümmel in his *Ozeanographie* gives the forty-second parallel as its extreme limit. Along the northern boundary it meets the cold American coast waters and a sudden change of temperature takes place, the mean in summer falling from 68° to 59° in three degrees of latitude. In longitude also there is a fall of temperature, and at 150° W. long. the Kuro Shiwo can hardly be called a warm stream. Subsequently it turns more southwards and flows as a cold current, the Californian stream, along the coast of California. Dall and Krümmel assume that a northern branch diverges from the main Kuro Shiwo on the latitude of Vancouver and flows northwards along the coast of Alaska to the Aleutian islands. Such a current certainly exists, but, as shown by Professor Davidson by the drift of trunks, buoys, etc., it exists as far south as the coast of California, and, instead of being connected with the Californian branch of the Kuro Shiwo, is rather of the nature of a compensation current; it is known as the "Davidson Eddy current."

Herr Lindenkohl's chart of specific gravities shows plainly the presence of a strip of warm salt water that thrusts itself northwards between the Californian stream and the coast. This is a prolongation of the warm stream that the heated waters of the Gulf of Panama send northwards along the coast of Mexico, and which Krümmel has traced to Cape San Lucas. In the winter it disappears, and the Californian stream extends to the coast. The lines of equal specific gravity follow in general the course of the isotherms. The Californian stream is of low density, while the greatest density occurs in the calm zone corresponding to the Sargasso sea in the Atlantic. Little is known of the vertical distribution of salinity except through the observations of the *Challenger* between Japan and the Sandwich Islands, which show conditions similar to those in the Atlantic in the same latitudes.

The three great streams crossing the warm zone of the Pacific have been thoroughly traced out by Dr. Puls (see vol. xii. p. 483), and Herr Lindenkohl deals only with their temperatures and salinity. The Californian current, flowing during the summer months at about forty-five miles from the coast south of San Francisco, turns more and more to the west, till between 20° and 5° N. lat. it assumes a due westerly direction, forming the North Equatorial current. On the voyage of the *Challenger* from the Sandwich Islands to Tahiti an almost uniform temperature of 43° was found at a depth of 400 fathoms between the Tropics, but the water was about half a degree warmer a little north o the Equator, about on the boundary of the South Equatorial and Counter currents. On the other hand, the coldest water above 400 fathoms was found at about 10°, or on the boundary of the North Equatorial and Counter currents. Hence it may be inferred that the warmth of the Counter current proceeds from the South Pacific. When it meets the Northern Equatorial, gaining in weight more by loss of heat than it loses by parting with some of its salt, it sinks and forces the colder lighter water of the North Equatorial to the surface. The Sandwich Islands lie on the northern limit of the North Equatorial, and the surrounding water has a specific gravity of about 1·026 and an almost constant temperature, summer and winter, of between 73° and 77°. To westward the temperature rises rapidly, showing that the Sandwich Islands possess an American rather than an Asiatic climate. In this direction Lenz, in 1824, found the lightest water in the North Pacific—1·0257. At its western end, in about 140° E. long., the North Equatorial current is compressed by the warm water from the South Pacific and the hardly colder water from the Japanese coasts, and appears as an attenuated stream in lat. 10° N. In consequence of the lateral pressure the colder water from below 500 fathoms is forced up towards the surface. Here also the temperature and gravity series show that the warm salt water from the south forces its way on sinking against the Equatorial current.

The Southern Equatorial current originates from the Peruvian current. Near the Galapagos Islands it apparently disappears for a distance of about ten degrees of longitude, since here flows in water eleven degrees warmer from the Gulf of Panama, and spreads itself over the Peruvian current. As the Kuro Shiwo is stopped by the cold water of the Kamchatka stream, it may seem surprising that the Panama water keeps its place on the surface. But the Kuro Shiwo contains a large proportion of salt and the Kamchatka current very little, whereas the difference of salinity in the Peruvian and Panama currents is very slight. The appearance of a belt of cold water on the surface of the South Equatorial under the Equator west of the Galapagos has rightly been explained by Dr. Krümmel as due to a welling up from below. Judging from the conditions in the North Equatorial current, we may suppose that the warm water on either side sinks down and drives the colder water towards the surface. Though the current appears to have greater strength, and exhibits lower temperatures than the North Equatorial, it begins to die out as a cold stream in about the longitude of the Sandwich Islands. The difference between the two is that the southern current, coming in contact with the warm and saline South Pacific water down to a depth of 200 fathoms, is exposed to a much more vigorous attack than the Northern Equatorial, which the South Pacific water reaches only after passing under the southern current.

The Counter current, beginning at the Philippines, traverses the ocean to the Gulf of Panama between 5° and 10° N. lat. It was the object of a special investigation carried out by the *Albatross* in 1891. Two lines of soundings were executed, one running from the Galapagos eastwards to Galera Point on the coast of South America, the other northwards to Acapulco. From the rapid change of

temperature below the surface observed along the first line, Agassiz concluded that a branch of the Peruvian current runs between the Galapagos and the mainland towards the Gulf of Panama, where it meets the Mexican continuation of the Californian current and the Equatorial Counter current. A comparison of the temperatures on the Acapulco line of soundings show that both the Galapagos and Counter currents must be much weakened. In the Gulf of Panama the *Albatross* found in winter very light water on the surface, while the gravity sank rapidly from the surface and the temperature fell as much as 25° in the first fifty fathoms. These facts show that there is no sinking of warm and highly saline water, and therefore it seems probable that the South Pacific water, advancing under the South Equatorial against the North Equatorial, falls into a *cul de sac* near Panama, and has to let its surplus salt fall to the depths.

The highest surface temperatures occur in late summer to the north of New Guinea. The absolute maximum, 87·4, was found by the *Rurik*, in 1817, near the Caroline Islands. The maximum surface density would naturally be looked for north of the North Equatorial in the neighbourhood of the air pressure maximum; and indeed, Makarof found the highest density in the North Pacific, 1·0276, in lat. 23° 50′ N. and long. 163° 16′ E. The highest temperature at a depth of 220 fathoms was found by the same observer in 30° 2′ N. lat. and 148° 19′ E. long., being 61·3° with a surface temperature of only 66·6°.

MISCELLANEOUS.

The missionary A. C. Kruijt has discovered a **new lake in Celebes**, at Lindu. It is about one-fifth of the size of the Posso lake and is drained by the river of Palos. The banks are marshy on all sides. Its elevation above sea-level is about 2950 feet. It is certainly not a crater lake.—*Petermanns Mitt.* Bd. 44. No. 7.

A new island has risen out of the sea off the coast of Borneo. It lies near Lambidan opposite Labuan. 220 yards long by 160 broad, it rises 60 feet above the sea and consists of loam and rock. Steam issues from its numerous fissures. It came into existence after a violent earthquake that convulsed Borneo.—*Deutsche Rundschau*, Jahrg. xx. Heft 5.

In January last died the noted Portuguese explorer, Captain Roberto Ivens. He accompanied Brito Capello in his journey from Benguella to Yacca, and subsequently, in 1884 and 1885, across the African continent from Mossamedes to Quilimane. The Spanish order of Isabella the Catholic was conferred on him in 1885 for his services to geographical science.

Mr. J. B. Hatcher, who left the United States in February 1896 for Argentina, to collect fossils, etc., for the Princeton University, has come across a river, which he has called the **Rio Mayer**, rising near Lago Argentino east of the cordillera, and flowing westwards towards the Atlantic (*Nat. Geogr. Mag.* Nov.). Further information will probably prove whether this river is the Gordiano of Señor Onelli (see vol. xii. p. 368), or a new discovery.

On Jan. 26th Mr. W. Mackenzie, of the firm of Mackenzie, Mann, and Co., of Toronto, signed a contract with the Dominion Government for the construction of 150 miles of railway from Glenora, 140 miles up the Stikine river, to **Teslin lake**, whence there is good navigation for river steam-boats to the Yukon. The line is to be completed by next September, six weeks before the close of the river navigation.—*The Canadian Gazette*, Feb. 3rd.

At the meeting of the British Association at Liverpool in 1896, Mr. H. N. Dickson proposed a plan for a systematic hydrographical survey of the **North Atlantic**. A grant of £100 was made to Mr. Dickson by the Council of the Royal Geographical Society, and during 1896 and 1897 a large number of samples, about 4000, were collected by captains of steamers, whalers, trading-schooners and trawlers. The results, when thoroughly worked out, promise to be of exceptional interest.

Professor Pettersson and his colleagues have received a grant from the Lars Hjerta's Minne established for a similar survey, but extending to the south of Mr. Dickson's limit, 40° N. lat. Biological observations also are included in the plan.—*Geographical Journal*, Feb.

The **metrical system** is to be introduced into Russia. In the course of the present year, private individuals and Government institutions will be permitted to use the metrical weights and measures. In order to make the system known throughout the country, instruction on the subject will be given in the village and railway schools and among the soldiers, and when the people have thus become familiar with the new weights and measures, their use will be established by law.—*Deutsche Rundschau*, Jahrg. xx. Heft. 5.

The British Museum is about to spend a sum of money contributed by Dr. John Murray in sending out Mr. C. D. Andrew to investigate the fauna and flora of **Christmas Island**. This small island, fourteen miles long by eight broad, lies in the Indian Ocean some 250 miles south of the western extremity of Java in lat. 10½° S. Its highest point is about 1300 feet above sea-level. This land is well wooded and contains five species of mammals, of which three are peculiar to it, while twenty-three out of its thirty-five species of insects are not found elsewhere.

The Spanish Government has realised the necessity of preserving the **forests** of the country, and as a preliminary has appointed a commission to classify them. The total area dealt with by the commission is 27,020 square miles, of which 19,500 square miles are covered with forests reserved for public use, while the remainder, 7520 square miles, may be sold forthwith, except in cases where the Ministry of Industry interferes. Thus the forest area of general utility amounts to less than one tenth of the area of Spain, though, indeed, the forest zone has a much larger extension. Since the beginning of the century, when forests covered a fourth of Spanish territory, a considerable portion has passed into private hands, and in some cases has been cleared to make room for crops, to the great advantage of the country, but in others has unfortunately helped to increase the area of waste lands. On the basis of the classification it will be possible to decide which forest-areas may advantageously be alienated, being capable of being turned at small expense into profitable farms, and which, from the character of the timber, the situation and nature of the soil, should be retained. Much also needs to be done for the preservation of forests from depredation.—*Revista de Geografia Colonial y Mercantil*, Tomo I. No. 7.

NEW BOOKS.

Korea and Her Neighbours: A Narrative of Travel, with an Account of the Recent Vicissitudes and Present Position of the Country. By Mrs. BISHOP, F.R.G.S., Hon. F.R.S.G.S., etc. With Maps and Illustrations. Two volumes. London: John Murray, 1898. Pp. 261 and 322.

This is the sixth of the narratives of travel and exploration which have placed "Isabella Bird" at the head of all Woman Geographers. Our own Society was the first to recognise the value and the charm of her services, alike to literature and to science, and our example was followed by the Royal Geographical Society. From the Rocky Mountains she passed to the Hawaiian Archipelago. Of the Golden Chersonese of the Malay region she then told us much that was new. She opened up unbeaten tracts in Japan, thereafter leading to the aborigines of Yezo. A few years after found her in India, whence she began her journey full of hardship, in Persia and Kurdistan, along the course of the Upper Karun, and among the Christians of the ancient Nestorian Church, now being swallowed up by Russia. And here she tells us just what we want to know of Korea at a time when its otherwise repulsive people, with their unique geographical advantages, abandoned of necessity by China, are the victims alternately of Japan and Russia. In all these works there is the same attraction of new facts and picturesque description set forth in a way which never strains the attention of the reader, though it may sometimes give the impression of fragmentariness. The wealth of Mrs. Bishop's original material is such that, if she has a fault, it lies in the absence of generalisation.

To her Korea was laid open, by King and Queen, British and Russian representatives, at a time of transition and transformation which can never recur in its history. We read her pages in the light of the events which are passing before our eyes in the Far East, and of the debates and blue-books which flood our Parliament and newspapers. Japan, which began the good work, has probably given place to Russia for ever, and must be content with its islands, unless the decadence of China helps it to a share of the mainland in time. Not the least of Mrs. Bishop's services, and perhaps the most interesting of her records, are found in her account of the condition of the twenty thousand Koreans who have settled in Russian Manchuria. To all who believe that what Christianity has made of the West, it will, in essentials, bring about among the Eastern peoples, Mrs. Bishop's impartial record of missionary progress gives a peculiar value to her writings. Next to David Livingstone, hers is the most valuable testimony to the sincerity and beneficent devotion of missionaries, especially medical men and women. Scotsmen, like Dr. Ross and Dr. Christie of the United Presbyterian Mission in Mukden, receive justice.

Sir Walter C. Hillier, our Consul-General for Korea, in his valuable preface, thus indorses her report: "I have no hesitation in saying that closer inquiry would dispel many of the illusions about the futility of missionary work that are, unfortunately, too common. They are always ready to place the stores of their local knowledge at the disposal of any one. Much valuable information as to channels for the development of British trade could be obtained by Chambers of Commerce if they were to address specific inquiries to missionaries in remote regions. Manufacturers are more indebted to missionaries than perhaps they realise for the introduction of British goods and wares and the creation of a demand for them." For the rest, this narrative of Mrs. Bishop's four visits to Korea, between January 1894 and March 1897, is a valuable contribution to our knowledge of the leading characteristics of the Mongolian races. The two volumes

are, outwardly, fine specimens of Edinburgh printing and map-making. Should Mrs. Bishop again seek new fields, we trust she will turn the light of her experienced observations on India, the north-western portion of which she has already visited, and with which the services of her uncle, Robert Mertins Bird, give her a hereditary connection.

The Christian Topography of Cosmas, an Egyptian Monk. Translated from the Greek, and edited with Notes and Introduction by J. W. M'Crindle, M.A., M.R.A.S., F.R.S.G.S. London: Printed for the Hakluyt Society, 1897. Pp. xxvii + 398.

By this translation our Fellow, Mr. M'Crindle, has done an even greater service to geography and to scholarship than by his English reproductions of the classical writers on Ancient India, Ctesias, Arrian, Ptolemy, and the author of the Periplus. Cosmas, merchant, navigator, monk, and advocate of a system of the universe which describes the world as an oblong, like a lady's Saratoga trunk, has not hitherto been translated into English. Surnamed Indicopleustes, because of his frequent voyages down the Red Sea to the Persian Gulf, Ceylon, and the Bay of Bengal, he could not help giving us much geographical and missionary information as to the East, in the sixth century of our era, although the one object of his long treatise is, as Gibbon puts it, to confute the impious heresy of those who maintain that the earth is a globe. This prodigy of literature, as Mr. M'Crindle well terms it, is worth translating, just because of the precious descriptions of the countries he visited, the inscriptions even which he stumbled on in Abyssinia, and the spread of Christianity in its Nestorian form over the coasts and islands at least of the Greater India. We forgive the sailor monk his oblong trunk theory, illustrated by his own drawings here reproduced—and skip therefore the greater part of his book—because of his vivid sketches of India, Ethiopia, and their seas in the days of the Emperor Justinian. He sailed on three of the great gulfs, which he describes as running up into the earth from the ocean, or the Mediterranean, the Red Sea, and the Persian Gulf. He could not have pictured India proper and Ceylon as he does had he not traded with their people, also with "Malé, where the pepper grows," and he tells us even more about Africa. Mr. M'Crindle credits him with having got as far as Meroe, now Khartum, while Montfaucon holds that he found the true source of the Nile in the Abyssinian province called Agau. Sinai and its desert he explored, where he found the rock-covered inscriptions which he traced to the wanderings of the Israelites under Moses. Unfortunately, his other treatise on descriptive geography is lost, a loss which Montfaucon justly says is to be deplored with tears. Our own Principal Robertson, as well as Gibbon, made use of Cosmas when writing of Ancient India. Alike by his Introduction, Notes, and Translation, Mr. M'Crindle has earned our gratitude. No longer will it be necessary to hunt over the original for the really valuable passages of historical and geographical import.

A Short History of British Colonial Policy. By H. E. Egerton, M.A. London Methuen and Co., 1897. Pp. xv. + 503. *Price* 12*s.* 6*d.*

There are, as Mr. Egerton says in his preface, several books dealing with the colonial policy of Great Britain from one or other point of view, but hitherto there has been "no book which deals with the subject systematically on historical lines." Mr. Egerton has undertaken to describe the relations between Great Britain and her colonies from the outset to the present day, and he has discharged his task—by no means an easy one—with a high degree of success. His book—it may be

said at once—is careful, thorough, trustworthy, and, within its self-imposed limits, as complete as it could be expected to be. The style in which it is written cannot be called brilliant, but, with occasional lapses, it is generally correct and intelligible. In his judgments, the author, who belongs to what, for want of a better word, it is the fashion to call the Imperialist school, displays both good sense and impartiality, combined with no little critical acumen.

The subject is limited in two directions. In the first place it is not a history of the colonies, or of British colonisation, but of the policy of the mother-country towards her colonial offspring. Secondly, the definition of a "colony" excludes a good many settlements which, in loose phraseology, are generally included under that name. "A colony" (says the author, rejecting Sir G. Cornewall Lewis' definition) "may be defined as a community, politically dependent in some shape or form, the majority or the dominant portion of whose members belong by birth or origin to the mother-country; such persons having no intention to return to the mother-country or to seek a permanent home elsewhere than in the colony." The last part of this definition appears to us a little arbitrary. It excludes, as the author says, not only India, but most tropical settlements and the military dependencies. Now Gibraltar and Aden may reasonably be omitted, but if British Guiana and Nigeria, the Straits Settlements and Borneo, are not colonies, what are they? And is not permanent settlement, rather than the life-long residence of individual settlers, the mark of a colony? It might have been better to adopt the legal definition fixed by the Interpretation Act of 1889, under which the word "colony" means "any part of the Queen's dominions, exclusive of the British Isles and British India." A more complete view of colonial policy would thus have been obtained. In the work before us the subject is, in fact, still narrower than the limits fixed by the author's definition would imply. Roughly speaking, the book hardly touches anything except the settlements which now form the United States and the three great groups of self-governing colonies, Canada, Australia, and the Cape.

The author divides his subject into three historical periods—(1) the beginnings, to 1651: (2) the period of trade ascendency (1651-1830): (3) systematical colonisation and self-government (1830-60): (4) the zenith and decline of *Laissez-aller* principles (1860-85): (5) the period of Greater Britain (since 1886). All such divisions are more or less arbitrary, and plausible objections could probably be made against any that might be chosen. We are not disposed therefore to quarrel with these dissections, except that 1840—when the era of self-government begins—appears to us as at least as important a date as 1830—the establishment of Emigration Commissioners; and we can see little difference between periods (3) and (4). Certainly the grant of self-government is one of the distinctive features of the *Laissez-aller* system, for it would not have been conceded—along with control of land, and other privileges—so easily as it was, but for the prevalent notion that it was only a step in what seemed then to be the inevitable process of separation.

In his view of the "beginnings," it was impossible for Mr. Egerton to add much to what has been already told by Mr. Doyle and others, but he gives an excellent sketch of the origin and growth of Virginia and other colonies. He defends the Virginia patent of 1606 against the somewhat unfair strictures of Mr. Doyle; he is also probably right in saying that "the economic need for emigration at the beginning of the seventeenth century was less than it has been sometimes represented." There cannot have been much pressure at home, with a population of only five millions: the love of adventure, the prospect of gain, and the desire for religious freedom were more powerful incentives. But why quote Professor Seeley as an authority for the foreign policy of the early Stuarts, in a field which

Mr. Gardiner has made his own? No one doubts Sir John Seeley's originality, but it is not in his remarks on this subject that it is to be found. And why does Mr. Egerton talk of the legal decisions of "C. J. Ley" (p. 37) and "C. J. Holt" (p. 136)? Can it be that he is unaware that "Ley, C. J." stands for "Chief Justice Ley"?

Mr. Egerton's statement, that "the Navigation Acts have been generally condemned by modern economists as having neither conduced to the naval nor commercial greatness of England," can hardly be allowed to pass without criticism. Sir Josiah Child, who declared in 1694 that they had doubled our mercantile marine within twenty years, is perhaps not a "modern economist," but Dr. Cunningham—the leading modern authority on Economic History—while pointing out that they were in some respects detrimental to commerce and the colonies, is clearly of Child's opinion so far as the mercantile navy is concerned. Mr. Craik in his *British Commerce*, Mr. Gibbins in his *Industry in England*, and Mr. J. E. Symes in *Social England*, all agree that, whatever harm may have been done to commerce in general, the shipping interest largely gained. On the other hand, the author's remarks on the colonial policy of the later Stuarts are much to be commended. He points out that "the general opinion . . . that our colonies were left for many generations almost wholly neglected," is not substantiated by an investigation of original authorities, and that the Stuart governments showed far more wisdom in their colonial than in their domestic policy. Whatever sins may be laid to the charge of Charles II. and Shaftesbury at home, they deserved well of the empire beyond the four seas.

Nor were their principles departed from for some time after the Revolution. "It is a strange irony" (says Mr. Egerton) "which has fastened the epithet tyrannical on the conduct of England [*i.e.* before the reign of George III.] towards her colonies." The origin and growth of American grievances are well described, but here—as in other parts of the book—there is some lack of arrangement, and the reader who is not pretty familiar with the subject is likely to be somewhat bewildered by a want of perspective and proportion. Mr. Egerton has deliberately adopted a chronological treatment rather than the "essay" form. Partly, no doubt, in consequence of this, the salient lines are not clearly drawn, the leading facts are not grouped together, and the result is a somewhat blurred and indistinct picture. As Mr. Egerton has, evidently, studied Sir John Seeley to some purpose, it is a pity, perhaps, that he did not a little more closely follow his method. His book is full of information, no little of it new, and almost all of it sound and relevant, but it is sometimes difficult to see the wood for the trees; by a little thinning here, a little expansion there, and a little dotting of the *i's*, its lessons might be much more forcibly driven home.

The first half of the book, roughly speaking, is occupied with the story of the colonies which were lost in 1783: the rest deals with Canada, Australasia, and the Cape. Lord Elgin, the author thinks, was "the first great Colonial Governor who realised the Governor's special business, as the missioner of the Greater Britain idea." He quotes several extracts from his despatches, which conclusively show that he not only anticipated the feelings but the methods which, we may now hope, have saved the Empire from the greatest disaster that could have befallen it. It was a pity that he was for so long a prophet in the wilderness. Similarly, Mr. Egerton does justice to the efforts of Lord Beaconsfield to prevent the Manchester school and the dominant party of the day from cutting the colonies adrift. It is well to realise how near we came, thirty or forty years ago, to this suicidal end. The chilling influence of Lord Blachford at the Colonial Office during the momentous years 1860-1871, Lord Granville's futile concessions to Germany,

Mr. Gladstone's ruinous policy in regard to the Transvaal—the whole dismal and exasperating story of our vacillations and tergiversations in South Africa—are well sketched in these pages. It is a pity that the Zulu war is not inserted in its proper place—before the rupture with the Transvaal: for to treat it later, as an affair apart, is to miss an important connection. The overthrow of Cetchwayo was for the Boers what the conquest of Canada was for the Americans: it relieved them of a pressing danger, and by saving them from their hereditary foe encouraged them to throw over the sovereignty which had hitherto protected them. It is, perhaps, rather unfortunate that Mr. Egerton regards the Pretoria Convention of 1881 as of no account. "Thoughtful men like Sir B. Frere" (he says) "saw that, for any practical purpose, it was so much waste paper." Sir H. Robinson described it in 1883 as an arrangement "which the one side does not intend to enforce, and the other does not intend to observe." We have reason to congratulate ourselves that the present Government is of a different mind. In spite of this—we can hardly call it pious—opinion, Mr. Egerton ends upon a hopeful note, and we may also conclude by thanking him for a work which it can do no one anything but good to read, containing, as it does, many lessons which it behoves every citizen of the Empire to lay to heart.

The United States—Vol. II. By E. Barnett Smith, author of *The History of the English Parliament*, etc. (The "Romance of Colonisation Series.") London: S. W. Partridge and Co., 1897. Pp. 320. *Price 2s. 6d.*

This second volume of the history of the United States relates their history from the seventeenth century up to date—very much indeed up to date, for it describes the election of Mr. Mackinley in March last, and touches on the Venezuela question. The troubles and difficulties which beset the States during this period arose chiefly from their strained relations with the mother country, and from local and internal conditions which are more or less incidental to all young colonies. The authorities in the mother country looked upon them with a jealous and unsympathetic eye. They cordially disliked and discouraged their aspirations for freedom and toleration in religion, and regarded them simply as a source of revenue and profit. In their new home the colonists had to contend with savage and treacherous aborigines, and it has to be confessed that their conceptions of religious toleration were crude and defective. Their shameful treatment of innocent Quakers will remain an ineradicable blot on their fair fame; and their ferocious and cruel crusade against wizards and witches is a lamentable episode of their history, which can only be regretted, although in this respect they merely followed the bad example of the mother country. Deeply imbued with a spirit of antiquated religionism, which recalls the Scotch Covenanters, many of the colonies deliberately proposed to rule themselves and their dependants on the obsolete principles and practices of the Mosaic law. In New England, for example, "All persons were forbidden to run or even walk, 'except reverently, to and from church' on Sunday, or to profane the day by sweeping their houses, cooking their victuals, or shaving their beards. Mothers were even commanded not to kiss their children on that sacred day. . . . Blasphemy and idolatry were punishable by death. . . . Pecuniary mulcts were imposed on every person observing any such day as Christmas. . . . All gaming was prohibited; cards and dice were prohibited to be imported; and assemblies for dancing were proscribed. By a law enacted in 1646, kissing a woman in the street, even in the way of honest salute, was punished by flogging. . . . A male child above sixteen years of age, accused by his parents of rebellion against them and general mis-

conduct incurred (conformably with the Mosaic code) the doom of capital punishment; and any person courting a maid without the sanction of her parents was fined and imprisoned." It is very obvious that any community which endeavoured to enforce such principles strictly was bound sooner or later to come to grief.

Nevertheless the various States overcame one by one all internal difficulties and external foes, and the story of how they did so is well told. Owing to the fact that they did not combine till 1776, the story of each State has to be told separately, and as the States increased in number, and repeatedly changed their boundaries, the story is somewhat confused and difficult to follow, but the general characteristics and trend of their evolution are well brought out. The history of the United States from the Declaration of Independence till the present day is condensed into about sixty pages.

If this book ever reaches a second edition, the writer should supplement it with a good index, the want of which is an obvious blemish.

A Padre in Partibus. Being Notes and Impressions of a Brief Holiday Tour through Java, the Eastern Archipelago, and Siam. By the Rev. GEORGE M. REITH, M.A. Singapore, Hongkong, etc.: Kelly and Walsh, 1897.

These letters, originally written for the *Singapore Free Press*, are a record of six months' travel, during which the author visited Bali, Lombok, and Celebes, and crossed Java from Soerabaja to Buitenzorg and Batavia. They give a lively picture of the country and people as seen by a passing tourist, and will interest and amuse the English reader to whom Dutch and German works are useless. The author, wisely confining himself to details which fell under his personal observation, says little of the Dutch administration and colonisation. The few pages he does devote to the subject confirm the impression derived from other sources. There seems to be a lack of energy in extending Dutch rule among the native chiefs, most of whom, except in Java, are practically independent. The natives have no objection to the Dutch more than to any other foreign supremacy, but they long for independence, and the protracted war in Atjeh is weakening the prestige of the Government throughout the Archipelago.

Die Osterreichisch-Ungarische Monarchie. Geographisch-statistisches Handbuch für Leser aller Stände. Von Professor Dr. FRIEDRICH UMLAUFT. Wien, Pest, Leipzig: A. Hartlebens Verlag, 1897. Pp. 1192. *Price M.* 12.50.

The fact that Professor Umlauft's account of the Austro-Hungarian Monarchy has reached a third edition is the best testimony to its value as a reliable book of reference. This new edition is, in every respect, a highly meritorious achievement, doing great credit both to author and publisher. Being compiled with care and judgment from the latest and best authorities, it may be confidently recommended to the general reader, as well as to the geographical student, as a storehouse well stocked with information on every subject connected with the dual monarchy. More than half of its nearly 1200 pages are devoted to the physical geography of the different countries included in Austria-Hungary, while the rest is taken up with statistical and topographical detail. The only fault we have to find with the book is its arrangement; to obtain a complete survey of any particular region the reader has to seek his information in different parts of the book. This is, perhaps, not a very serious drawback in a work primarily intended for reference; and a complete alphabetical index, and frequent cross references, easily put the reader in possession of everything he desires. Numerous illustrations and a full supply of excellent maps enhance the usefulness of the book.

The Story of the Earth's Atmosphere. By Douglas Archibald, M.A. London: George Newnes, Limited, 1897. Pp. 108.

It is not often that a scientific subject is treated in a popular way with more success than is done by Mr. Archibald in this handy little book on the atmosphere. Without the use of technical terms he yet conveys to the general reader a complete idea of meteorological science, giving distinct and intelligible descriptions of the scientific reasons for observed facts. Debarring himself from writing of the weather and of meteorological instruments, he has omitted little in the known laws of atmospheric phenomena, and the whole is put so simply and clearly that it is a pleasure to read. There is a fascinating chapter on "Suspension and flight in the atmosphere," in which Mr. Archibald gives an account of aerial photography and of the progress of experiments in aerial navigation up to the present time. He considers that the flying-machine of the future must be evolved from the kite and not from the balloon. The detailed description of modern kites and of the methods of photographing from them is particularly interesting.

Koloniales Jahrbuch. Herausgegeben von Gustav Meinecke. Das Jahr 1897. Heft ii. Berlin: Deutscher Kolonial-Verlag, 1897. Pp. 67-138.

This part opens with a discussion on the fitness of German South Africa for a penal settlement. Dr. Bruck pronounces in favour of the project, while Graf Pfeil in a very able rejoinder adduces many weighty reasons against it. From the discussion it appears that the value of German South Africa to the small farmer is very problematical. Another interesting article is supplied by a settler in Bibundi, who, in opposition to views recently expressed by missionaries, maintains that as yet there does not exist a liquor question in West Africa. Dr. Hiltz recommends the introduction of the Torrens' System of Land Registration.

The Statistical Year-Book of Canada for 1896. Issued by the Department of Agriculture. Ottawa: Government Printing Bureau, 1897. Pp. 464 and Index.

Although of such importance, it is a difficult matter to review a Statistical Year-book. The present issue of this Canadian official volume is the twelfth, and it has been compressed with a view to wider general distribution. We are bound to say that Mr. G. Johnson, the editor, has been most successful in his object, and the volume does not lose in the information contained nor in the clearness with which it is presented to the student. We had nearly written "reader," but few "read" a book of statistical matter. Canada prospers, and long may she do so; her action this year, and the impulse given to gold-mining, seem to point to a still greater degree of prosperity in the near future.

A Bibliography of Geography, being the Sections relating to that Subject in "The Best Books" and "The Reader's Guide." By William Swan Sonnenschein. London: Swan Sonnenschein and Co., 1897. Pp. 305-382 and 236-296. *Price* 4*s.* 6*d. net.*

The books from which the *Bibliography* are excellently arranged, and their usefulness has been fully tested, and therefore the excerpt may be recommended to geographers. One thing, however, should have been done, and that is, the date to which the bibliography is brought down should have been stated on the title-page. It is only from an advertisement at the end we learn that this date is 1893-94.

NEW MAPS.

AFRICA.

NIGER, Carte de la Boucle du ——. Dressée par le Lieutenant Spicq, de l'Infanterie de Marine. 1897. Echelle de 1 : 1,500,000. 2 Feuilles.
Service Géographique des Colonies, Paris.

The map, based on that of Captain Binger, is compiled also from the explorations of Marchand, Monteil, Mizon, Toutée, and many other travellers who during he last few years have traversed the country in all directions, and whose routes are laid down. Large districts which were blank on Binger's map are now more or less filled in. The sources of the Niger, with the Anglo-French frontier, now appear, and the neighbourhood of Timbuktu with its lakes. The Togoland boundary was not fixed early enough to be shown on the map.

SOUTH AFRICA, Bartholomew's Tourist's Map of ——, prepared from the latest surveys. Scale 1 : 2,500,000, or 39·4 English miles to 1 inch. *Price, on cloth*, 3*s*. *The Edinburgh Geographical Institute*, 1895.

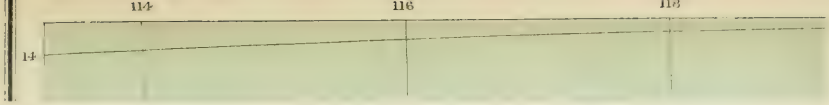
The title *Tourist's Map* seems scarcely appropriate. Railways and roads are marked on it and numerous towns, but the most conspicuous and important feature of the map is the orography. This is very clearly portrayed in brown, white, and green, the shades being separated by contour lines in pink. The execution is remarkably sharp. The map shows that, except on the coast, for a short distance up the river valleys, and in Portuguese territory, no part of the country up to the latitude of Palapye is below 2000 feet, while a large proportion lies more than 4000 feet above sea-level.

ATLAS.

MONTHLY STAR MAPS FOR 1898. By Walter B. Blaikie.

These maps are intended for the use of those who have but little previous knowledge of the constellations, and therefore only the principal stars are shown. These are marked, as seen in London at 10 p.m., on the two maps for the first of each month—of the northern and southern celestial hemispheres—in gold on a dark blue ground. By daylight, though the effect is pleasing to the eye, the stars are not very easily distinguished, but it will be found that they stand out very conspicuously in a poor light, such as will be used by an observer out of doors at night. The moon and planets are marked in white.

The book contains much besides the maps—notes on the movements of the moon and planets, and on telescopic objects, tables of the rising, setting, and southing of the sun and moon, and corrections for the southing of the sun for the principal towns of the kingdom, by means of which the time of observation may be regulated for other places than London, etc. etc. Special mention may be made of a circumpolar projection of the heavens, on which are also projected the horizon of the observer and the zodiac, with the movements of the planets during the year. With the aid of a piece of paper or cardboard, this diagram may be used as a planisphere. The apparent retrograde movement of the planets is explained with the help of a diagram, and the mysteries of mean time are briefly but clearly set forth. In the latter exposition the equal description of areas might have been cited as the reason the sun moves more quickly when nearer to the earth, and a small diagram would have shown the variation caused by obliquity of the ecliptic. It may, however. be questioned whether the tyro would be greatly enlightened by these additions, and certainly he will find enough to digest in these pages. With the aid of nothing beyond ordinary intelligence, he will acquire much useful knowledge about the apparent motions of the heavenly bodies.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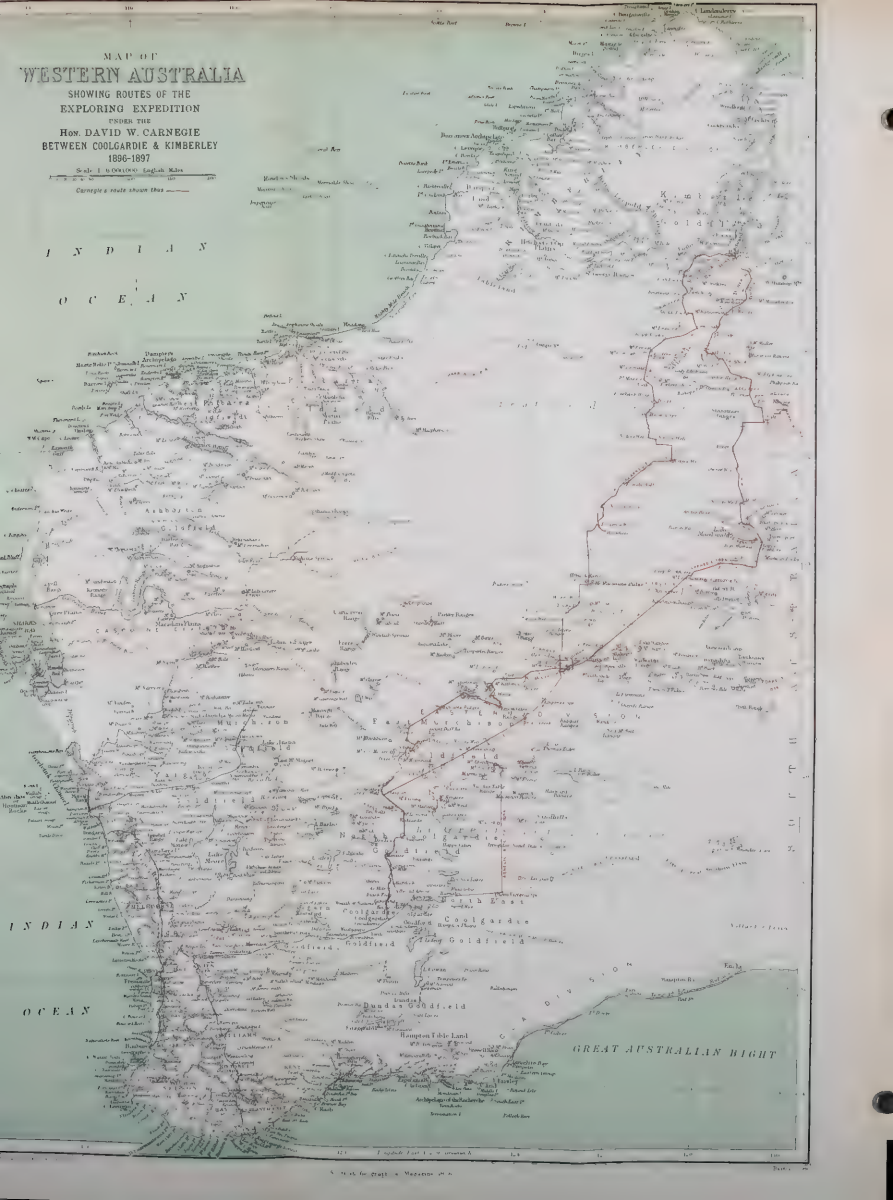

MAP OF
WESTERN AUSTRALIA
SHOWING ROUTES OF THE
EXPLORING EXPEDITION
UNDER THE
Hon. DAVID W. CARNEGIE
BETWEEN COOLGARDIE & KIMBERLEY
1896-1897
Carnegie's route shown thus
INDIAN
OCEAN
GREAT AUSTRALIAN BIGHT
Coolgardie
Goldfield
Dundas Goldfield
Houghton Table Land

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE MATERIAL GROWTH AND PRESENT CONDITION OF THE UNITED STATES.

By Henry Gannett,

Geographer, U.S. Geological Survey.

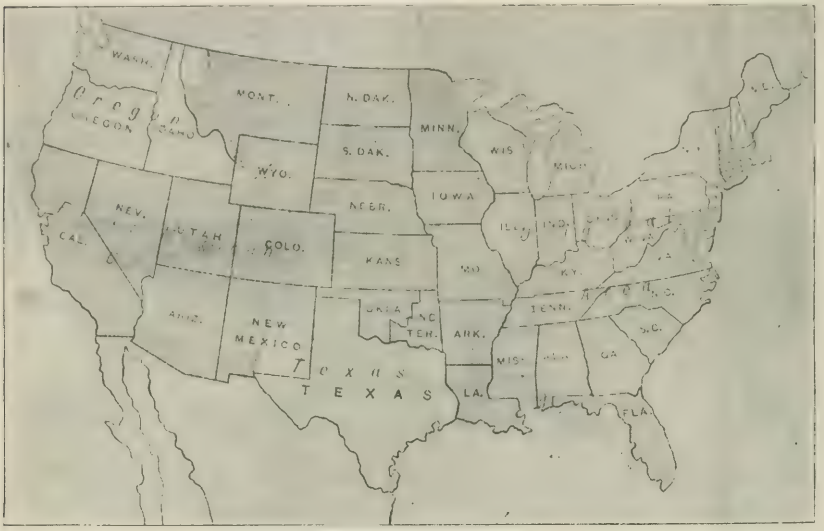
(*Read at the Meeting of the British Association, Toronto*, 1897.)

Territory.

At the conclusion of peace with the mother country, at the close of the Revolution, the United States exercised jurisdiction over the territory east of the Mississippi river and north of the parallel of 31°, the northern and eastern boundaries being the same as at present. These limits enclosed an area of a little more than 900,000 square miles, or about one-fourth the present extent of the country. At various times accessions were made to this territory, the first being that of Louisiana, in 1803, which was bought from the first Napoleon for a song, because he believed it to be in imminent danger of seizure by Great Britain. With it came Oregon, now the States of Idaho, Washington, and Oregon, although the title of the United States to that tract was not recognised by Great Britain until many years thereafter. Then, in 1821, the Floridas were purchased from Spain, not because the territory was particularly desired, but because it seemed to be the easiest way to settle a perplexing quarrel with that country regarding limits. In 1847 Texas came into the Union of her own volition. The south-western States and Territories—California, Nevada, Utah, Arizona, most of Colorado and New Mexico—were acquired by conquest from Mexico, although the United States went through the form of purchasing the region. The last acquisition was that of Alaska, purchased from Russia in 1867.

Thus the territory has grown, by a few great accessions, from a little

more than 900,000 square miles to 3,600,000 square miles, and at present comprises about one-half the land of North America. With the exception of Alaska, it is in one compact body, covering most of the temperate zone of the continent, and extending from sea to sea. Alaska may be dismissed from this discussion. Although vast in extent, its population and productions are as yet trifling in comparison with those of the main body of the country.



ACCESSIONS OF TERRITORY (EXCEPT ALASKA).

The great features of the country are simple. Its skeleton is composed of a high, broad mountain system, occupying the western portion of the continent—the Cordillera—and a lower, narrower system in the east, the Appalachians. From the latter the land slopes to the Atlantic coast, this incline being known as the Atlantic Plain. Between the two systems of elevation is a broad valley, with long slopes on either side, the northern part of which is drained by the Great Lakes and the St. Lawrence, and the southern part by the Mississippi.

Within this territory the mean annual temperature ranges from 70° to 35°, the highest temperatures being upon the Gulf coast, and the lowest on the northern boundary and the summits of the Cordillera.

The rainfall ranges from 125 inches per year to zero. It is highest on the north-west coast and along the shore of the Gulf of Mexico, and it is least in the interior deserts of the Cordilleran region. Over the Mississippi Valley and the Atlantic Plain it ranges from thirty to sixty inches.

Population.

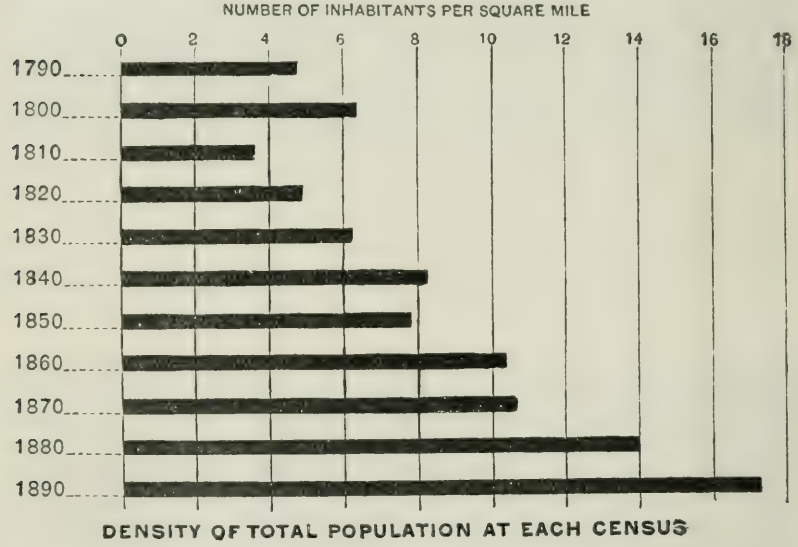
With this brief outline of the domain of the United States I will now try to summarise the progress which the people has made in its

THE TERRITORY AND SETTLED AREA IN 1790.

THE TERRITORY AND SETTLED AREA IN 1890.

development. Settlement commenced in the early part of the seventeenth century, but it was not until 1790 that any authentic data were obtained regarding the people or their industries. In that year the first census of the United States showed a population of, in round numbers, 3,900,000. They were scattered along the narrow strip of sea-coast from Maine to Georgia, and for a short distance inland. Only in two or three localities had settlement extended as far as the Appalachian range. A century later, in 1890, the population numbered nearly 63,000,000, and settlement extended across the continent, covering much the greater part of the country, the unsettled areas being mainly in the deserts of the Cordilleran region. The progress of settlement, at the beginning and end of the century, is shown upon the maps.

In 1790 the United States comprised a Union of thirteen States. In 1890 there were forty-five States, four Territories, and the District of Columbia.

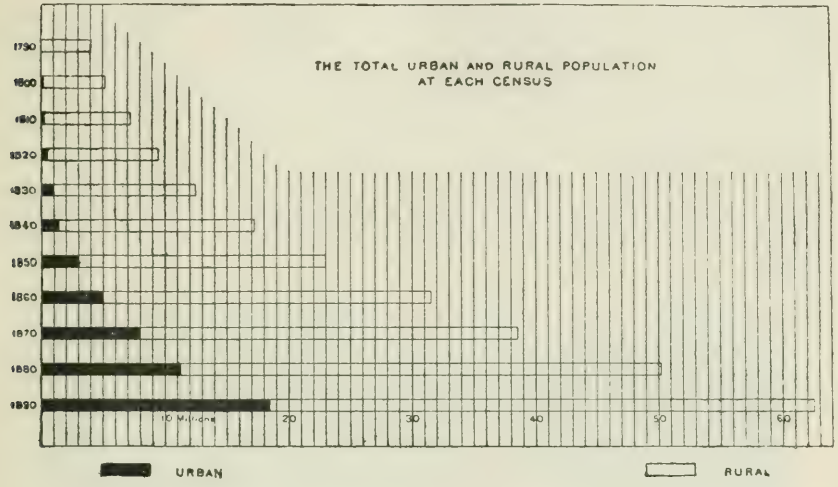


The increase of population has been phenomenal. In one hundred years the population was multiplied sixteen times; in the last fifty years more than four times; and the percentage of increase in different decades ranged from 23% to 36%.

The density of population over the entire area of the country has oscillated, owing to the accessions of territory, although on the whole it has rapidly increased. It was nearly five inhabitants to the square mile in 1790, dropping in 1810 to less than four, owing to the addition of Louisiana, and in 1890 it exceeded seventeen to a square mile.

The population of the various States in 1890 ranged from 6,000,000 in New York down to 45,000 in Nevada, and the density of population of the several States ranged from 318 in Rhode Island to less than one-half a person to a square mile in Nevada.

The movements of the population, including their migrations from one part of the country to another, and the differences in their natural increase in different parts of the country, are summarised in the movements of the centre of population. This, which was located near Baltimore, at the head of Chesapeake Bay, in 1790, has travelled westward, keeping close to the 39th parallel of latitude, until in 1890 it was in southern Indiana. The urban element, defining it as the number of inhabitants who dwell in cities of 8000 or more, has steadily increased during the century, at a rate much more rapid than that of the total



population. At the time of the first census only $3\frac{1}{2}\%$ of the inhabitants were urban; at the last census more than 29% were living in the cities. The proportion of urban population in the different States in 1890 ranged widely, from Rhode Island, where nearly four-fifths of the inhabitants lived in cities, down to certain of the southern and western States in which the proportion was trifling. In the north-eastern States, taken collectively, more than half the people lived in cities, and in the northern central States more than one-fourth, indicating not only the location of the great urban centres, but also of commerce and manufactures.

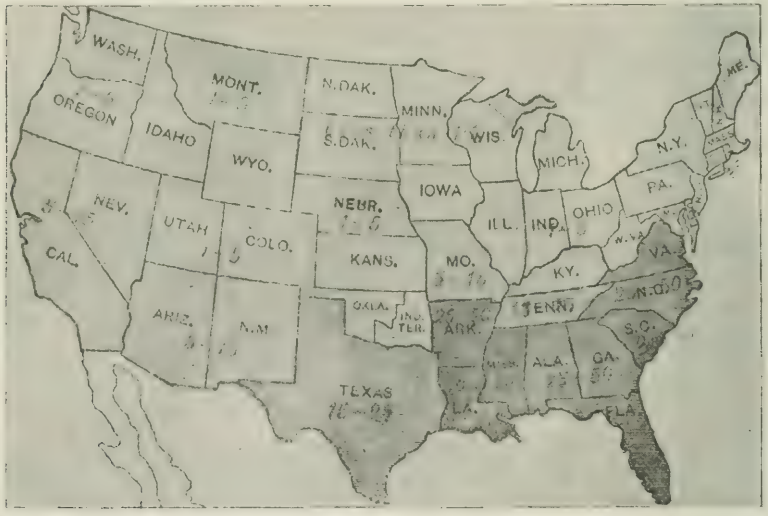
In respect to sex, males have, since 1850, been slightly in excess of females, there being, on an average, about 102 males to 100 females in the population. This excess of males is probably due to immigration, which adds largely to the numbers of the male sex. In the eastern States, as a rule, females were in excess of males, while in the central and western States the reverse was the case, especially in the latter, where the excess of males was in many localities very great, owing to the existence of frontier conditions.

The average number of persons to a family has steadily diminished since 1850, when the data were first obtained, from 5·55 persons to 4·93 persons. In 1890 the smallest families were in the north-eastern States, the minimum being in New Hampshire, where the average family con-

sisted of 4·31 persons, while the largest families were in the southern States, the maximum being reached in Virginia and Texas, where the average family comprised 5·44 persons.

Race.

Statistics of race have been obtained at each census for a century. The principal race distinction is that of Whites and Negroes, in the latter class being included all persons of mixed negro and white blood. In later censuses, since the migration of Asiatics has become of importance, these classes also have been distinguished by the census. In 1790 the population was composed of 3,172,006 Whites and 757,208 Negroes, the proportion of the two races being of Whites 80·73% and of Negroes 19·27%. In 1890 the same elements numbered 54,938,890 and 7,470,040, the proportion being, of Whites 87·80% and of Negroes 11·93%. Thus during the century the proportion of Whites has increased greatly, and that of the Negroes has correspondingly diminished. This change has been a progressive one, each census, with but two exceptions, showing an increasing proportion of Whites and a diminishing proportion of Negroes.



PROPORTION OF COLOURED TO TOTAL POPULATION IN 1890.

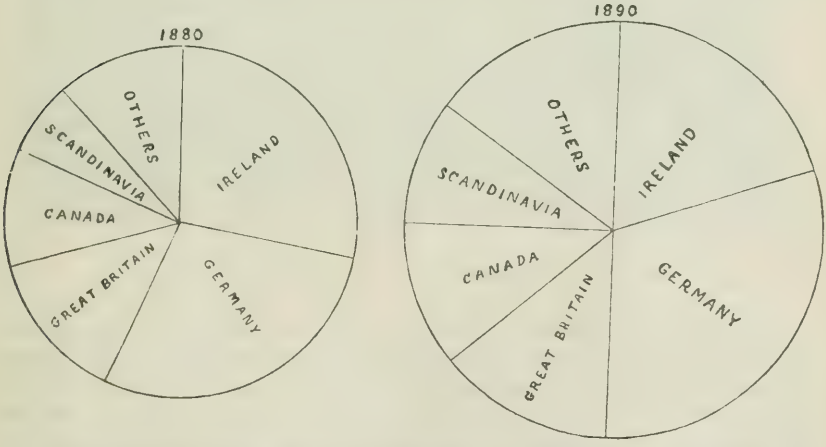
The habitat of the Negroes has been, throughout our history, the southern States, *i.e.* those south of Mason and Dixon's line and the Ohio river. Within this region were found, in 1890, nearly nine-tenths of the entire number. Of the total population of these southern States the Negroes formed, in 1890, about one-third, but this proportion ranged widely among the different States. In South Carolina nearly three-fifths of the people were Negroes, in Mississippi much more than one-half, and in Louisiana just about one-half; while, on the other hand, in Kentucky

they formed only about one-seventh of the population, and in West Virginia but about one-twenty-fifth.

Birthplace.

During the last half of the century under consideration, *i.e.* from 1840 to 1890, the population of the United States has been largely recruited by immigration. During this period 15,500,000 Europeans have migrated across the Atlantic to the United States, a migration unparalleled in history. Of this enormous immigration the United Kingdom has supplied nearly 6,250,000—3,500,000 of which have come from Ireland. Germany has sent 4,500,000, Norway and Sweden nearly 1,000,000, Austria-Hungary more than 400,000, and Italy nearly as many. Of the total immigration more than 40% have been drawn from the United Kingdom, and nearly 30% from Germany. The two countries together have supplied more than two-thirds of the total number of immigrants.

In the census of 1850—the first in which a distinction was made between persons of native and foreign birth—there were enumerated 20,947,274 persons of native birth and 2,244,602 of foreign birth, the foreign-born constituting at that time 9·68% of the population. Forty years later, in 1890, the native-born numbered 53,372,703 and the foreign-born 9,249,547, the proportion of foreign-born having become 14·77% of the population.

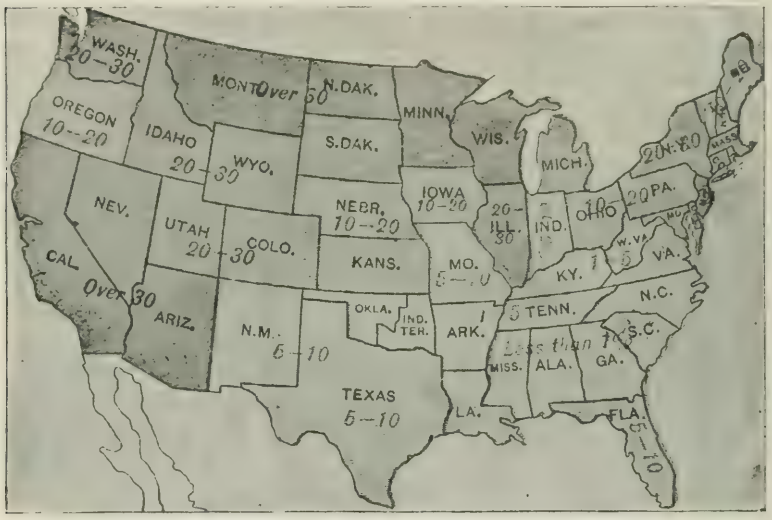


FOREIGN-BORN IN 1880 AND 1890 ACCORDING TO THE COUNTRY OF ORIGIN.

In 1850 nearly half of the element of foreign birth was composed of Irish, and one-fourth of Germans. British, including English, Scotch, and Welsh, comprised about one-sixth. In succeeding censuses the proportion of Irish and British diminished, while that of Germans increased, as did the natives of Canada, of Scandinavia, and of other countries. In recent years the proportion of Poles, Italians, and Hungarians has greatly

increased, although not at all comparable as yet with those of the other nationalities mentioned.

The distribution of persons of foreign birth is complementary to that of Negroes. Nearly all the foreign-born are found in the northern and western States, where they do not come into labour competition with Negroes. While in the United States, as a whole, the foreign-born constitute 14·77% of the total population, they form 22·34% of the population of the north-eastern States, 18·16% of the population of the northern central States, and 25·46% of that of the western States. Among individual States the proportion ranges much higher. In Rhode Island it exceeds 30%, in Massachusetts 29%, in New York 26%, while in Wisconsin it exceeds 30%, in Minnesota it is nearly 36%, and it reaches a maximum in North Dakota, where it exceeds 44%.



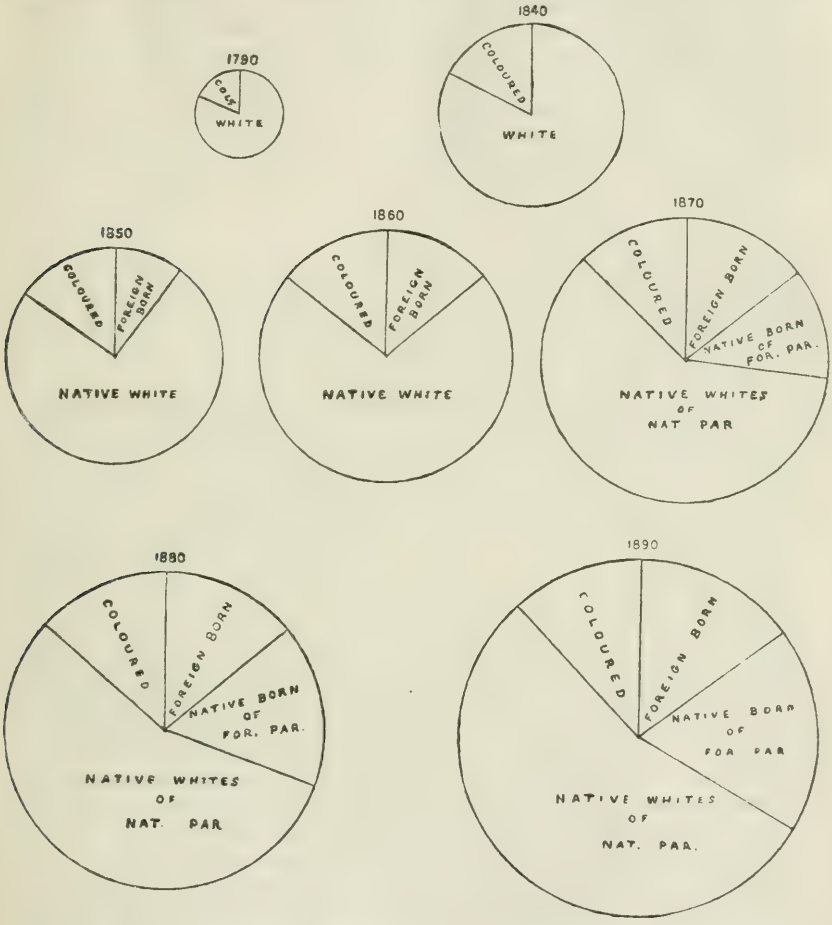
PROPORTION OF FOREIGN-BORN TO TOTAL POPULATION IN 1890.

The last three censuses have made a further distinction in the matter of nativity, classifying the population not only as native or foreign-born, but subdividing the native-born into two groups—of native-born of native parentage, and native-born of foreign parentage. Of the latter class the number in 1890 exceeded 11,000,000, and this class, together with the foreign-born, formed nearly one-third of the whole population. They are found mainly in the northern States, their distribution being quite similar to that of the foreign-born.

The population and its elements, so far as classified by the different censuses, is represented on the following diagram, the area of the circles being proportional to the population. In the first six censuses the only distinction shown was that between white and coloured, and the proportions varied but slightly. In 1850 and 1860 the distinction of foreign

birth is added; and in 1870, 1880, and 1890 the additional distinction of native and foreign parentage is also made.

The classification of the population by race and nativity, and by States, shows that North Dakota has the smallest element of white natives of native extraction, only 20% of its people falling into that



THE TOTAL POPULATION AND ITS ELEMENTS.

group. Minnesota follows, with about 24%, and Wisconsin with 26%. South Carolina and Mississippi, as noted before, show the greatest proportion of Negroes, while at the other end of the list West Virginia is the most purely American of all the States, its population comprising 87% of native Whites of native extraction.

The great cities of the country, *i.e.* those containing over 100,000 inhabitants each, twenty-eight in number, show great diversity in the composition of their population. The first in the list is Milwaukee, with

but 13% of natives of native extraction; New York follows with 18%, and Chicago with 21%. The only cities whose population comprised 50% of white natives of native extraction were Denver, Indianapolis, and Kansas City.

One or two interesting results, which deserve mention, have followed the flood of immigration to this country. The first is the fact that this enormous migration has increased but little, if at all, the population of the country. *A priori* we should expect this result. The tendency of the natural increase of the people is to diminish gradually as the country becomes more densely settled, and, the conditions of occupation remaining the same, the more rapidly the country becomes settled the more rapidly does its rate of natural increase diminish. The fact must be recognised that it does not matter in the least in what manner this increased density of population is brought about, whether by natural increase or by immigration. The result is the same. The crowding of people, with the difficulty of obtaining employment, and the resulting scarcity of bread and meat, are the cause of this reduction in the rate of increase, and the same effect is produced whether the increase is caused by natural growth or by immigration.

So much for theory. Now, if we examine the rate of increase of the northern States, where practically all the immigrants have settled, we shall see that on the whole it has diminished quite steadily during the entire century. It is true that the great rush of immigration in the latter part of the decade between 1840 and 1850 produced a temporary rise in the rate of increase for that decade, but immediately after things settled down to a regular rate of diminution. If we compare the increase between 1790 and 1840 on the one hand, with that between 1840 and 1890 on the other, we find the latter much less than the former, in spite of the fact that 15,500,000 people came to the country during the latter period. Furthermore, if the rate of increase of the southern States, which have received no accession through immigration, be compared with that of the northern States, which have received the entire flood during the past half century, we find their relative rates of increase are directly comparable with similar rates during the first half of the century, *i.e.* from 1790 to 1840. All of this shows that the coming of this enormous number of people to the northern States has resulted in a great reduction of the native increase.

Another marked result has been produced, which will come out more clearly when speaking of the occupations of the people. Immigration has been mainly confined to the working classes, especially to those engaged in manufacturing occupations. Immigration has resulted in driving Americans from these occupations to the professions and to the farms, in which occupations most of the native stock are now engaged.

Illiteracy.

The people of the United States maintain, throughout the length and breadth of their country, an excellent system of public schools, supported by taxation, through which all children can obtain, without direct cost,

the elements at least of education. The result is seen in the low proportion of illiteracy among the people, particularly among the Whites of native birth. Out of the total native white population, of ten years of age and over, only 8·7% were unable to write. Of the foreign-born population the corresponding proportion was 12%, and of the coloured not less than 70%. The illiteracy of the population, ten years of age and over, differs widely in different States, being naturally least in the northern and western States, and greatest in those of the south. The smallest proportion of illiteracy is found in Wyoming, where only 3·4% of the population over ten years of age are unable to write. The smallest proportion of illiteracy among the native white population is found in Massachusetts, where only one person in 133 is unable to write.

Religion.

There is no State religion in the United States. Owing to this fact, and to the great variety of creeds represented there, coupled possibly with the prevalent freedom and independence of thought, the United States contains a great number and variety of religious denominations. About one-third of the people subscribe to some creed. Of these the most numerous are the Catholics, which comprise about one-sixth of the whole church membership, followed by the Baptists and Methodists in almost equal numbers. The last two churches are largely recruited in the south, and are composed in great part of Negroes. These three denominations jointly contain much more than half the entire church membership of the country.

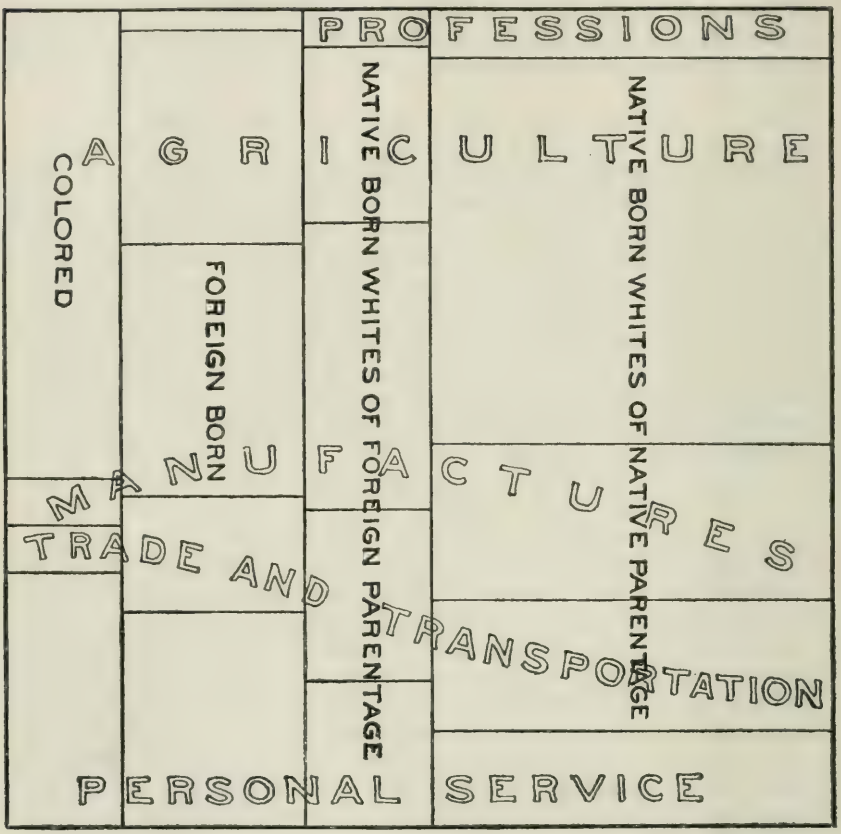
Age and Sex.

For the discussion of the population according to age and sex the following classes are taken:—(1) the total population; (2) the native Whites of native parentage; (3) the native Whites of foreign parentage; (4) the foreign-born; and (5) the coloured. In the total population the males and females are about equal in number, and the number of persons in each age-group diminishes regularly with increasing age. The second class exhibits very similar features, excepting that the proportion of the younger element is greater than among the total population. The third class contains a great preponderance of children, and shows a rapid diminution in number as the ages increase, so that the number of aged persons is very small. In the fourth the reverse is the case; the number of children is trifling, while the maximum is reached among the adults; moreover, the males are greatly in excess. These peculiar features are, of course, due to the character of the immigration. In the last class the variations are very similar to those of the second, males and females being almost equal in numbers, and the numbers becoming smaller quite regularly with increasing age. There is, however, one noticeable feature in the coloured class, which is the fact that the children under five years of age are less in number than those between five and ten years of age. This may be explained upon one or two

hypotheses, either that the birthrate of the Negroes has suddenly diminished, or that the enumeration of young coloured children was defective.

Civil Condition, Sex, and Age.

The chief results obtained by the census are that women marry younger than men, as is, of course, well known; and that widows are far more numerous, at all ages, than widowers, owing doubtless to the fact that widowers remarry to a greater extent than widows, and choose



OCCUPATIONS OF THE ELEMENTS OF POPULATION.

maids rather than widows. About 51 per cent. of each sex are married; the widows are about $14\frac{1}{2}$ per cent. of the total number of females, while the widowers amount only to about $5\frac{1}{2}$ per cent. of the males.

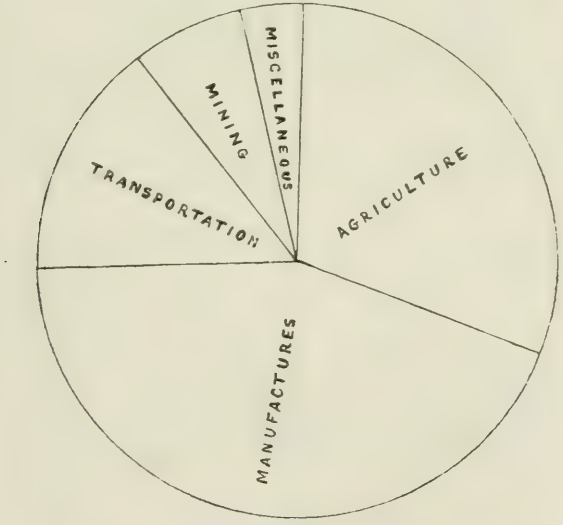
Occupations.

This diagram represents, by the entire area of the square, the wage-earners of the country. It is divided vertically into rectangles representing the number of wage-earners of different races and nativities,

the native-born Whites of native parentage, the native-born Whites of foreign parentage, foreign-born and coloured. Each of these is subdivided horizon tally into five great groups of occupations—professions, agriculture, manufactures and mining, trade and transportation, and personal service. It is to be noted that the professions are represented most largely among the native-born Whites of native parentage, and least among the Negroes; that agriculture is proportionally represented most largely among the natives, and next to that among the native Whites of native parentage; that manufactures and mining, trade and transportation are represented to the greatest extent, proportionally to the numbers, among the foreign-born and those born of foreign parents, while also proportionally to their numbers personal service, by which is mainly meant domestic service, is supplied most largely by the Negroes, next by the foreign element, and lastly by the native elements of the population.

Industries.

The relative value of the principal industries of the United States in 1890 is shown on the accompanying diagram. The net value of



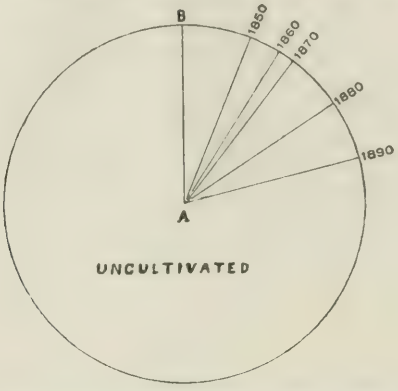
RELATIVE VALUES OF THE INDUSTRIES OF THE UNITED STATES IN 1890.

manufacturing industries, amounting to over $4,000,000,000, is easily of first importance, greatly exceeding the products of agriculture. That is, of course, second in importance, followed by transportation and mining.

Agriculture.

The number of farms in the country in 1850 was but 1,500,000; in 1890 it had trebled. The value of farms had increased in an equal

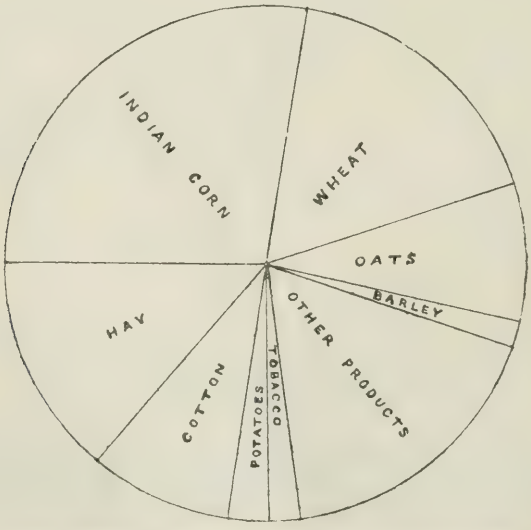
proportion, while at the same time the average size of farms had diminished. The amount of cultivated land increased from 113,000,000 acres in 1850 to 358,000,000 acres in 1890. In the latter year more



PROPORTION OF CULTIVATED LAND TO TOTAL AREA OF THE COUNTRY.

(The area of cultivated land at each census is represented by the Sector contained between the vertical radius AB and the radius marked with the date of the census.)

than one-fifth of the area of the country, excluding Alaska, was under cultivation.



PROPORTIONAL VALUES OF THE PRINCIPAL PRODUCTS OF AGRICULTURE IN 1889.

The proportion of cultivated land ranged widely in different States. It was highest in the States of the upper Mississippi valley. In Ohio,

Illinois, and Iowa, nearly or quite three-fourths of the area was under cultivation, but in the densely settled States of southern New England, with New York, New Jersey, and Pennsylvania, the proportion was much less, owing to the broken character of the country and the predominance of manufacturing interests. On the other hand, in many States of the far west less than 1% of the land has been devoted to the service of man.

Of the principal agricultural crops, Indian corn or maize was the most valuable, contributing more than one-fourth of the entire agricultural product. It was followed in value by wheat and hay, while cotton and oats had nearly equal values. The tobacco crop was a matter of minor importance, being of less value than even the potato crop of the country.

The great cereal crops of the country are wheat, corn, and oats. These are mainly produced in the northern central portion of the country. Wheat is produced in large quantities all over the north and upon the Pacific coast, but in most of these States no more is raised than is needed for the support of their people. Most of the wheat for export comes from Minnesota, the Dakotas, and California. Indian corn, or maize, is produced in nearly all parts of the country. It is only in the States of the extreme north that the climate is too severe for this cereal. The greatest production, however, is in the States of the upper Mississippi valley, and westward over the Great Plains, particularly in Kansas and Nebraska, where for hundreds of miles one rides through a succession of corn fields.

Oats, being a hardy cereal, are produced principally in the northern States, especially in those of the upper Mississippi valley and about the lakes.

The culture of cotton is confined to the southern States, especially those bordering on the Gulf, with Georgia and South Carolina. Practically none is produced north of the Ohio river, and very little in the border States.

Tobacco is produced in nearly all the States of the Union, but in the majority of them in small quantities, merely for local consumption. As an export crop it is highly localised, nearly half the crop of the country coming from the single State of Kentucky, and this State, with Virginia, Ohio, North Carolina, Tennessee, and Pennsylvania, produces fully four-fifths of the whole.

Manufactures.

Manufacturing industries have had an extremely rapid development —a hot-bed, forced development—in the United States, due in large part to its protective system. The leading facts regarding this group of industries in the past forty years may be set forth by a few figures. In 1850 the capital invested was but $533,000,000; in 1890 it was $6,534,000,000, or more than twelve times as great. The number of persons employed has increased from 957,000 to 4,712,000; the wages paid from $237,000,000 to $2,282,000,000, and the net product from $464,000,000 to $4,211,000,000. These figures show something be-

sides an enormous growth. The increase of capital has been at a far greater rate than the increase in the number of labourers; the wages paid have also increased far more rapidly than the number of labourers, showing an increase in wages per hand; the net product has also increased at a far greater rate than the number of labourers, showing a great increase in efficiency per hand. These facts indicate, in a broad way, the extent to which machinery has been substituted for hand labour. Another fact which appears from these figures is that the United States is to-day the greatest manufacturing nation on earth. It is commonly understood to be the greatest agricultural nation, but its importance in respect to manufactures is not commonly realised.

Mineral Products.

The total value of the mineral products of the United States in the year 1896 was $622,000,000—not a large amount, as compared with the products of manufacture or of agriculture, but, on the other hand, much larger than the mineral production of any other country. The principal items are, first and foremost, coal, which was mined in that year to the extent of 186,000,000 tons. Of these 48,000,000 tons consisted of anthracite, which was taken from an area of a few hundred square miles in north-eastern Pennsylvania. The remainder, 138,000,000 tons, consisted of bituminous coal, which is mined at many widely separated localities; indeed, coal is found in more than half the States of the Union, and is mined in most of these. Two-fifths of the production, however, comes from Pennsylvania, and half of it from the two States of Pennsylvania and Illinois. Ohio also contributes a large amount, and Alabama and West Virginia are also heavy producers.

Next to coal in importance is pig-iron, of which 8,600,000 tons were produced. The ore for this was principally derived from the iron ranges of northern Michigan, Wisconsin, and Minnesota. Pennsylvania also contributes much iron ore, as does Alabama. The smelting of iron is mainly carried on in the western part of Pennsylvania, about Pittsburg, although there are numerous large works in other parts of the country.

Nearly all the petroleum of the earth comes from wells in the eastern United States, Pennsylvania, New York, and Ohio. This was produced, in the year 1896, to the value of $58,500,000.

The silver production of the United States, amounting to nearly 59,000,000 ounces, had a coinage value of $76,000,000.

The production of gold had a value of $53,000,000. This came mainly from the States of the Rocky mountain region and the Pacific coast.

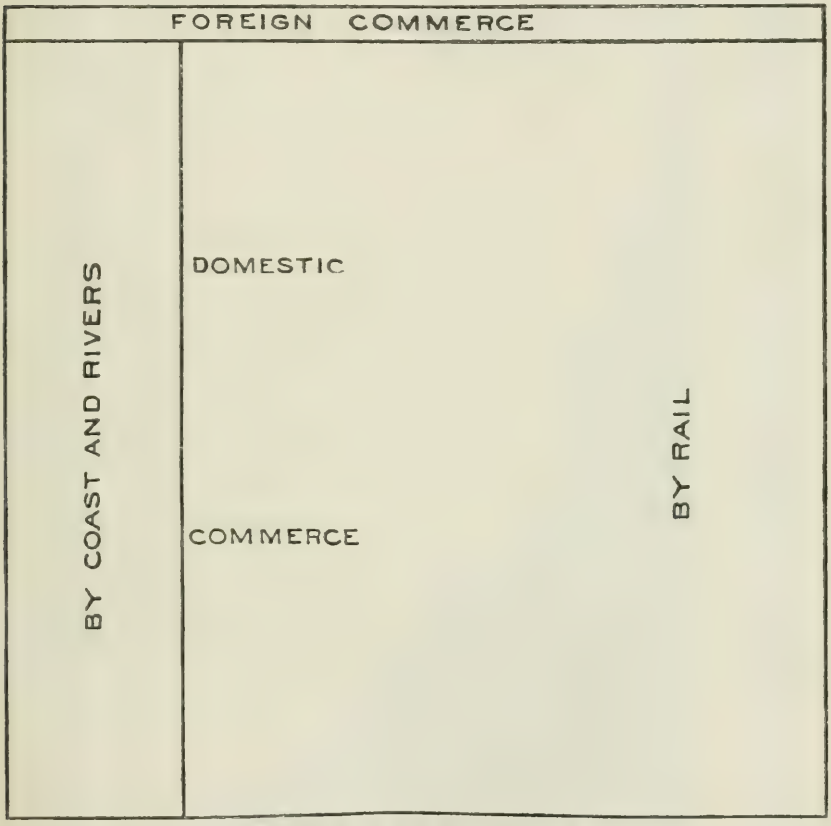
The value of the copper output was nearly $49,000,000. Half of this came from Keweenaw Point, in northern Michigan, and half from the mines about Butte and Anaconda, Montana, a small portion being derived from mines in Arizona.

The lead is derived mainly from the silver mines of the west, largely from Colorado and Utah, where it is mined as a secondary or by-product.

Zinc comes mainly from mines in south-eastern Kansas and south-west Missouri; and quicksilver from mines in the coast ranges of California.

Transportation and Commerce.

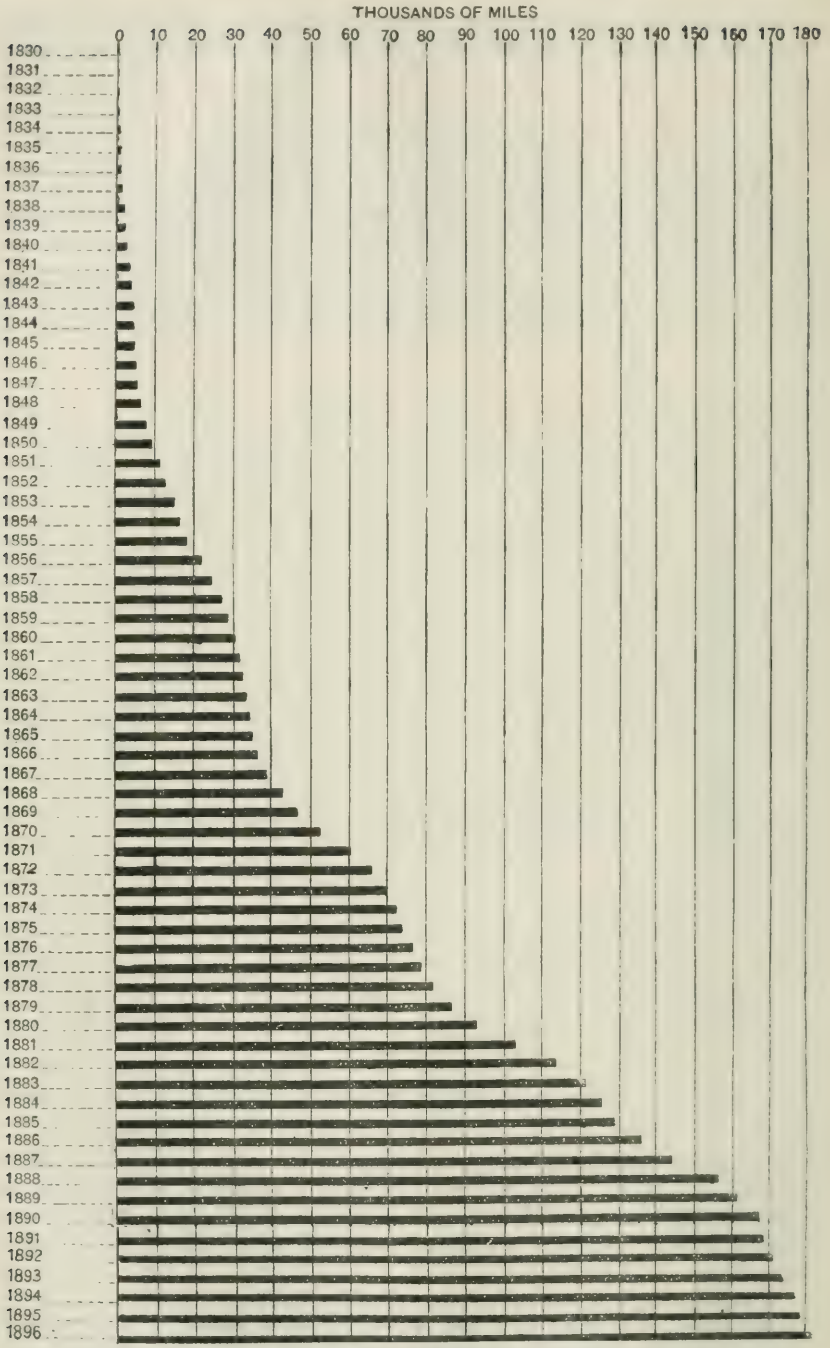
The highways of internal transportation comprise, besides the seaboard and the Great Lakes, a score of thousands of miles of navigable rivers and 180,000 miles of railway. Upon the sea, lakes, and rivers, the



COMMERCE OF THE UNITED STATES.

tonnage of vessels employed in traffic was, in 1890, 7,633,676 tons, or nearly as many as employed by Great Britain, the queen of the seas. Of this tonnage less than a million was engaged in foreign trade, the vast majority being engaged in domestic trade, and most of it upon the lakes and rivers.

The railroad development of the United States has been one of the most remarkable features of its industrial history. Starting in 1830 it has, in sixty-five years, built nearly 200,000 miles of railway, an average



RAILROAD DEVELOPMENT OF THE UNITED STATES.

of nearly 3000 miles annually. In one year, 1887, nearly as many miles were built as the entire number of miles in operation in England and Wales, and vastly more than the entire length of the great Siberian railway when completed. The mileage in the United States at present is greater than that of all Europe combined, and nearly as great as that of the rest of the earth.

The commerce of the United States is of enormous dimensions, but naturally in a country so broad, with such a variety of products, making it very nearly self-supporting, this commerce is almost entirely internal. The foreign commerce is to the internal commerce in volume in the proportion of 1 to 24. The volume of the internal commerce may be summarised by the statement that 808,000,000 tons of merchandise were transported in the year 1890, the average length of the journey being 120 miles. Of this vast tonnage, more than 11 tons per inhabitant, nearly five-sixths, or 636,000,000 tons, was carried by rail, and 172,000,000 tons by vessel.

Few statistics are available for the details of this internal commerce. It is known that anthracite coal is transported in all directions from the centre of production in north-eastern Pennsylvania; that bituminous coal is transported outward from all centres of production; that there is a great movement of iron ore from the shores of Lake Superior southward to Chicago, Cleveland, and Pittsburg, for smelting; that there is an enormous amount of meat and grain, particularly wheat, transported eastward from the regions of production to Atlantic ports, especially New York; that there is a movement of cotton from the Gulf States to New England, and that there is a general movement of manufactured goods from the north-eastern States to other parts of the country.

The foreign commerce of the United States is small, as compared with the total production of the country. Its exports consist, in great measure, of food products, especially grain and cotton. In recent years the exports of manufactured goods have largely increased, going mainly to Western Europe. Its imports consist mainly of coffee, sugar, and manufactured goods, the latter coming principally from Great Britain. Its chief port of entry is New York, the most important commercial port in the world. From this port go one-half the exports, while it receives two-thirds of the imports of the country.

Wealth.

The wealth of the country was first estimated in 1850, and a similar estimate has been made at each succeeding census. The later estimates have been, presumably, of greater accuracy than the earlier ones. In 1850 the total wealth of the country was estimated at little over $7,000,000,000, and it has increased rapidly, until in 1890 it was estimated at about $63,000,000,000. It has increased at a much more rapid rate than the population, as is shown by the fact that in 1850 the estimated value *per caput* was but little over $300, while in 1890 it exceeded $1000 *per caput*.

ALONG A SHAN ROAD.

SOUTHERN SHAN STATES, UPPER BURMA.

By Wm. Sutherland, Assistant Superintendent of Telegraphs, Lower Burma.

The word "road" is used in the heading for want of a more appropriate term, but any one who has been under the necessity of moving himself and his kit along such as we are here concerned with, knows exactly to what extent these surface scratches deserve the name.

Frequently, when one makes a tour at right angles to the main lines of communication in Burma, one finds a cart road for so many marches, and a bullock or mule track for the rest. The main lines of communication in Burma are, of course, the Irrawaddy river and the Burma State Railway, practically parallel to one another, and running north and south.

Suppose you leave the railway at Thazi junction, a few hours' journey south of Mandalay, and wander east along the southern Shan States road to Taungyi, the capital of the States, and from there straight on to Saikan, Kenghkam, and across the Salween river for a short way. Carts are obtainable from Thazi to Taungyi, a distance of 108 miles, divided into ten stages: the first three of these are in Burma proper, and from there on you are in the southern Shan States. A number of carts, sufficient to carry all your kit, having been engaged, you make a start. All the carts but one leave about 1 A.M., so that on arrival at the stage bungalow there may be time to prepare breakfast before you arrive. This one remains behind to carry your bedding and early breakfast crockery. You wake up at 5 A.M. to find that, though this is the cold season, and just that stage of it in which you may expect a few showers, it is raining heavily. Yes, this is no cold weather shower, but a regular monsoon downpour. You think it would be advisable to remain where you are for another day; then you remember that the carts, and consequently the commissariat, have already gone on, and you must needs follow or starve. When you are preparing to mount your pony the horrible thought occurs to you that your waterproof is also in one of the front carts, and before you arrive at the end of the stage water is running out at the tops of your riding-boots. You have a large sun-hat on, so your hair is dry—and nothing else. When you reach the *dâk* bungalow (stage rest-house) you find it full up. Two road-overseers, coming down the road on transfer, are already there with their wives and families. You cannot turn them out or make them move on in this kind of weather, and you cannot amalgamate the two parties in one set of rooms, because the rooms are limited, while the families are not. There is nothing left but camp out on the verandah. You turn a table on its edge, and behind its scanty shelter have a tub and a change. The table can only screen you in one direction, the verandah is open to the other inhabitants from three sides, and you are presumably a modest man.

The first couple of stages are practically on the plains, over level country, where travelling would be easy, if the rain had not turned the black-cotton soil road into a long ten-foot-broad trough of viscous mud, through which your carts are dragged, the bullocks wading over their knees in the mud, and the cart-wheels sinking up to the hub. When you come to a particularly nasty bit you cut down branches of trees and collect bundles of coarse grass and ferns, and throw them in front of the wheels to give some consistency to the road. After the carts have crossed one of these sloughs your pony frequently manages to get his feet mixed up in the submerged branches, and you have to dismount and wallow about till you get him free, and then give him a heave out from behind. When you are ready to mount again, and the sun has dried the mud with which you are entirely coated, the only signs that betray the fact that you are not a native are your clothes and the language in which the muttered soliloquy with which you relieve your feelings is expressed. The third stage brings you into the hills, and the road, as far as consistency goes, improves considerably, the gradient quickly carrying the water away. One difficulty, however, is scarcely removed when others present themselves. At one place half of the road has been washed away, and has to be temporarily repaired to allow the carts to pass; at another rocks dislodged from above have rolled down, and imbedded themselves in the road, and have to be digged out. Slowly, however, though by no means surely, the train of carts creaks along, and if you get over one and a half miles an hour on an average you are lucky. Half-way between two stages you may find a cart has broken its axle, and any that may be behind it are stopped, as there is not room to pass. When you arrive on the scene all the drivers are seated in a circle, smoking cheroots and cooking their rice, and the bullocks have been turned loose into the jungle. This is a time not to lose one's temper. If you bustle the men now they will probably bolt into the jungle, and when they reappear on the road again they will be miles away, and have their backs towards you. Leave them to have their smoke and chew their betel-nut. After that has been brought to a satisfactory conclusion, they will mend the axle, probably reach the end of the stage by nightfall, and seem surprised to find that you are there before them.

The scenery gets prettier and the view more extensive day by day as you reach higher levels. From the verandah of one house you can see the one where you will sleep on the following night. It seems quite close, but it is a few thousand feet above you, and eight stiff miles must be traversed before you get there. At one time you are going along half-way up the side of a steep ravine: on one side the rocks go straight up, and on the other sheer down to the very bottom, where you hear the rushing and tossing of a mountain torrent, swollen with the late rain, as it hurls itself down to the plains. The undergrowth is almost impenetrable, and huge trees overhang the road at the most fearful angles, requiring, one would think, only the vibration of a passing cart or a peal of thunder to release their roots, and bring them crashing over the road, on their headlong way to the river-bed below. In these places the road receives the rays of the sun only for a few hours each day, and it is, con-

sequently, in a chronically damp state. A smell of damp vegetation pervades it, and, except the noise of the stream, the only sound that strikes your ears is the drip-drip, patter-patter, of the moisture that falls from the rocks and overhanging foliage on to the dead leaves below.

You probably have your gun with you on the march, as not infrequently you may, on turning a corner, find three or four jungle fowl, or a brace of silver pheasants, feeding on the track. If it is ready loaded a successful shot will probably reward you for the trouble. The report of that one shot, rebounding from crag to crag, and throwing back echo after echo, is more like the sound of the distant firing of a whole battery of artillery than of a twelve-bore gun, and as it gradually dies away the returning stillness appears more intense than ever. Again, you emerge on to the top of a range lined with fir-trees, and the pleasant perfume of cones crushed on the track saturates the cool morning air. You are pretty high up now, the timber at various levels giving a rough indication of the elevation. The ridge forms, perhaps, a circle of about six miles in diameter, enclosing a basin partially cultivated and dotted over with bamboo clumps, each clump generally concealing a native habitation. The road runs round a low-level contour on the inside of the range, high enough up to be out of the inundated basin during the wet season, so that you may have to ride twelve miles before you reach that bungalow opposite you.

On every march you meet a few Shans travelling by easy stages. Burmans and Shans measure distances by the number of times they halt. Their equivalent for "mile" is literally "sit down," and a sit-down is equal to two and a quarter English miles. At this distance apart, or nearly so, you find there is always a favourite tree, selected on account of the density and extent of its shade, under which they have their sit-down and a smoke before proceeding farther. If another traveller arrives they exchange news, and, if this is interesting, they may have a brew of tea over it, nay, even postpone their further journey for the day. The Shans, like all Eastern tribes, travel during the morning and evening, and never stir during the heat of the day if they can avoid it. They wear, or rather carry, large heelless shoes with upturned toes. On the road they generally carry them, wearing them only when walking over thorny places or other bad ground. They also wear a pair of very large and baggy trousers, which on the march they pick up at the bottom, slide up their legs and tuck under their belts, exposing good muscular limbs, completely tattooed from the knee-joint to the waist. Their jacket is of silk or cotton, according to the means of the wearer, and is very loose. It has buttons in front which are seldom used, their chest, also tattooed with a variety of designs, being left bare. Their heads are crowned with a mass of long hair knotted under a handkerchief, and the whole is surmounted by a very large and pliable straw hat, which droops gracefully over the face and neck, and is ornamented with a coloured tassel—a chain or string keeps it fastened under the chin. Over one shoulder they sling a bag of many colours, often ornamented with shells, in which they carry their pipe, tobacco, and betel box. In the belt is fastened a small basket without a lid, big enough to hold a very threadbare blanket, or cotton sleep-

ing-cloth; a *dah* (long knife) is slung over the shoulder, or stuck in the belt. The Shans are an inoffensive people and honest, until they become contaminated by the rapidly advancing civilisation.

You may by chance meet a local magnate travelling to meet one of the political officers, or to see a friend. He rides a small Burman pony, surrounded by a body of retainers, armed with a most promiscuous set of weapons, including bows and arrows, spears, flint-locks, muzzle-loaders, revolvers (American), and *dahs* of every kind and size, from the ivory-handled *dah* in a silver sheath to those with common bamboo handles and sheaths.

At these higher levels the mornings are misty and the sun rarely penetrates the vapour before eleven o'clock. As you wind your way over the ridges you look down on sheets of mist, like so many calm and beautiful lakes hemmed in by rugged and heavily wooded mountains; while, when you descend, the sun becomes obscured, the temperature falls, and in a few minutes your clothes are quite wet. If you do the last march but one into Taungyi late in the day, so that the moisture may have had time to disperse, you will see the lake at Fort Stedman gleaming about eight miles away, as the crow flies, in one direction, and Taungyi on the top of a line of cliffs about twelve miles off in another. Before reaching these cliffs you have before you eight miles of painfully straight and dusty road across the Sinhe valley. From Sinhe a diversion can be made to Fort Stedman, which can easily be reached in one march. A row on the lake will alone repay you for the extra journey. The Intha boatmen propel their boats in a fashion that an average waterman and gymnast combined would not easily acquire to perfection. The two boatmen stand up, one in the bow and the other in the stern of the canoe, balance themselves on one leg, twist the other round the shoulder of the paddle-blade, and so pull it through the water, using one hand to guide it. Spears constitute part of the furniture of the craft. These the men carry in the unoccupied hand, and as they paddle along spear passing fish with amazing skill.

Two and a half miles from Sinhe bring you to the bottom of a six-mile ascent reaching the top of the Taungyi cliffs, within two and a half miles of Taungyi itself, at a height of 5000 feet above sea-level. In these ascents there are always short cuts for the pedestrian, and often available for ponies. Beware, however, of bridges built of only two boughs side by side across small streams. If your pony is not used to the work his hind legs will probably miss the only foothold which protects himself and his rider from broken bones, if nothing worse.

In Taungyi there are civil and political officers, and there is a Government experimental garden where grow strawberries, peaches, and many other fruits and vegetables not procurable in the plains, for the production of which great credit is due to some of the residents. Taungyi itself is situated on a plateau at the top of a line of high cliffs looking down on Fort Stedman, and at the bottom of a hill crowned with the usual pagoda. There is a beautiful residency for the superintendent of the States, and the usual bungalows and offices of the civil officers. The leading feature of the bazaar is a few stores roofed with galvanised iron,

where you can get all ordinary necessaries at prices that must yield a large profit to the avaricious Chinamen who sell them.

At Taungyi both cart road and *dâk* bungalows end, and new varieties of obstacles have to be overcome. There will be no more broken axles, and no more full bungalows, but when you get back to the sound of the creaking of the unoiled wheel you will perhaps greet that sound with feelings of intense satisfaction. A halt has to be called to unpack all your boxes and get your kit, stores, and tents made up into 40-lb. loads. A bullock can only carry 80 lbs. (40 lb. a side) on tracks such as you will have over these hills. While the bullocks are being arranged for and the loads adjusted, you may, by riding twenty-four miles, see the annual Möng Pawn fair. Get a pack-pony from the bazaar and put enough eatables on it to last you for two days, and early breakfast on the third. You may be able to get a mounted policeman as a guide. Starting early, you ride ten miles over hilly and partially cultivated country to Kompo. After waiting for an hour to give the ponies a rest and feed, you saddle up again and descend into a paddy (rice) plain, with a river, which has to be forded, running through it. Here the policeman comes in handy as he knows a ford. Without his help you would probably have to swim your pony across and finish your ride in wet clothes. The twelfth mile from Kompo brings you to Shwe-ma-lin, and two miles farther is the village at which the fair is held. Here the Sabwaw (local chief) will put a bamboo hut at your disposal, in which you can eat and sleep. The fair lasts for three whole months, and to the bitter end every one seems to take part in it with unabated energy. There is a half-mile straight course where all the ponies brought in for sale can be put through their paces. Except this, and the ordinary bazaar, every available corner seems to be given up to gambling. The usual gaming-table consists of a cloth, spread on the ground, round which the gamblers squat. It is divided into four quarters, the two on the right hand being "even," and those on the left hand "odd." The two outer quarters are blank; the two middle quarters are subdivided into spaces, each of which is marked with a number of pips similar to those on the faces of the dice. You bet on a throw of the dice being an odd or even number. If you bet on "odd" you put your money on the "odd" extreme blank quarter, and if you win you get your own money back and as much again. If you bet on a particular odd number, say 7, you put your money on the "odd" subdivision marked 7, and the banker bets 14 to 1 against that being the number thrown. The banker takes a percentage on everything staked. This method of gambling is adapted to the means of both rich and poor by having tables with different limits to the stakes allowed. At some the lowest current coin, the pie, is the limit. There are three pie in a pice, four pice in an anna, and sixteen annas in a depreciated rupee; so the limit is not an extravagant one. At other tables the limit varies from Rs. one to Rs. ten, or, indeed, may be expanded to any amount by mutual agreement. It is not uncommon for a man to come into the fair from an outlying village with, say, two bullocks, their trappings and his kit, and to leave in a few days with nothing but the clothes he carries on his back, the rest of his property having been staked and lost. One

feature that particularly strikes you on these occasions is that you may go into these gambling-bazaars any night, and at any hour of the night, without once hearing a high word or seeing a quarrel. Losing or winning both go on without ceasing, but without loss of temper or bloodshed. What a contrast to more civilised countries! Night after night the gambling goes on, the numbers at the tables being apparently unreduced by the counter attraction of a *pwe* (play), though the latter also seems well attended.

The *pwe* takes place under a circular thatched roof supported by bamboo posts and open on all sides. In one place, at the edge of the ring, a dais has been raised for the Sabwaw, his wives and friends, and on this he will offer you a seat. If you accept it he will introduce you to those around him, and explain anything you do not understand. The orchestra squats inside a circle of drums of all sizes and shapes. These are beaten furiously and apparently at random by any member who happens to have a hand or foot unoccupied at the moment. There are other instruments, too, brass and reed. The manner in which these instruments withstand the ferocity of the attacks made on them by the musicians speaks volumes for the good workmanship of the maker. The result is terrific, the din excites your blood like the bagpipes, and you, too, want to beat the drum. Close by the orchestra is the dressing-room. There are no partitions or curtains to screen it off from the public gaze. It is simply a space set apart for the purpose. The princes and princesses of the play may be seen changing and adjusting their costumes. The dancing-girls produce hand-glasses and powder-boxes, and perform their toilet in front of you, and while the play is going on. Whatever part of the circle is not monopolised by the dais, the orchestra and the dressing-room, is the stage. The prince or villain, or whoever he may be, stops suddenly in the middle of an animated discourse, borrows a cheroot from one of the audience, and lights it at the nearest torch. Before resuming his part he probably gives a light to a fellow-actor to save trouble. The actors perpetrate huge jokes and provoke peal after peal of laughter from the entire audience. There is no entrance-money, presumably because there is no entrance, or, rather, because the building is all entrance. The company is paid a fixed sum to perform at the fair: the village headman gathers the amount from the villagers and hands it over. The company is generally fed at the expense of the village it happens to be staying at. When you find the *pwe* becoming monotonous you say good-bye to the Sabwaw, and take another turn round the tables preparatory to turning in to rest before your ride back to Taungyi in the morning.

On your return you find the backbone of repacking has been broken, and only a few details remain to be arranged. You have now to serve out blankets and cardigan jackets to your servants and followers, for a tent is a cold shelter on the hills in the winter season. With pack-bullock transport you have frequently, more especially when there is a moon, to march at night or very early in the morning, so as to bring the animals under shelter before the sun is high. Everything in these cases depends on the fitness of your transport team: if you overwork it, it breaks down and then you are stuck. In these cold mornings you

stumble along in the still uncertain light on your pony, feeling miserably cold in spite of a heavy coat and pair of gloves, and watch the sky-line, praying that the sun may soon get up and thaw you. You have not to wait longer than the first day on which you load up the bullocks to find out at least one of their faults. They have been out of work since last season, and they take to it again as kindly as a schoolboy to his lessons after the long vacation. The loads are packed in baskets at either end of a crossbar which, by equal division of weight, balances on a cushioned saddle. Neck and tail ropes keep the load from slipping backwards or forwards as the animals go up or down hill, but nothing except balance keeps them from sliding round the animals' girths. This the bullocks soon find out, and so do you, to your cost. The first bullock is no sooner loaded than away he races in leaps and bounds, the load slips round, and he trips over it. Then commences a struggle to get free, involving the total demolition of everything breakable in the load. Lamps and liquor, being the most precious articles and the hardest to replace, generally suffer most severely. This performance, on first starting, goes on intermittently for several hours before the last load is fairly on the road, but even after that at intervals one bullock or another dashes off into the jungle, the result being invariably the same. When your first camping-ground towards Saikan is reached—it is at the village of Hopoung—you have to wait for a day and send back your men in skirmishing order to recover various missing articles scattered along the route. The weariness of an idle day is somewhat relieved as it happens to be bazaar-day in the village, and there are green pigeons to be shot a little way outside it. These bazaar-days generally occur every four or five days, and then the whole neighbourhood flocks in to buy and sell. The bazaar building consists merely of several long parallel rows of thatched roofs supported on bamboo posts, with a bamboo flooring underneath raised about eighteen inches from the ground. On this flooring the merchant squats and spreads out his merchandise. There are stalls of all descriptions. The jeweller is there with his stock of ready-made samples of ornaments for women and of betel-nut boxes for men. He will carry out any order he may receive if you merely supply him with the necessary weight of silver in rupees. There is the pottery man, who sells water-pots and earthenware vessels of all sizes and shapes down to the bowls of pipes; the china man with his teapots and cups; the general merchant who can supply you with anything, from English, Indian and China silks to needles, pins, thread and the hundred and one small articles which he seems to find a market for. In another row you have the butchers' shops, where you can get beef, if a bullock has been ailing past recovery, and pork or venison, if the hunter has been successful. Farther on there are the eating-house stalls; if you are a brave man and can face the awful and penetrating odours which emanate from that quarter you will take an interest in the menu. On the outskirts of the whole the women are selling vegetables and edible roots, the men are dealing in ponies, buffaloes or bullocks, and under a shady tree close by a mild gamble is going on. As the evening approaches the people gradually disperse. Those that have far to go

start early, and those that live close by remain till late, drinking tea, smoking and discussing the various events of what would appear to be a thoroughly uneventful life. You may sit down at any stall and examine anything or everything, but you will never be pestered to buy and no disappointment will be expressed if you do not. What a paradise for Western shoppers!

From Hopoung you pass through the Lāōn, Möng Pawn, Namoung, Palip and Wannoung camping-grounds to the Kant river, about seventy-five miles east of Taungyi, over hills and across valleys the whole way. Nearly every morning now you find the ground coated with hoar frost, and the cold is as intense as you could wish it, especially during the early morning ride. The Kant river is a considerable obstacle in your day's march. Though only about a hundred yards broad, it is deep and rapid, and has to be crossed on a raft. All the bullocks have to be unloaded and their packs rafted across, eight at a time. The animals themselves are driven into the stream and enticed to the other side by the persuasive and encouraging "Yaw Yaw" of a driver who has already been ferried across for that purpose.

On the far side are a few men sitting under a temporary shelter of bamboo and plantain leaves, and on a nearer approach you find they are natives sitting round one of their number who is in the last stage of exhaustion, dying of cholera. Poor fellow, he is quite beyond treatment and dies within an hour. His friends bury him and pass on as if nothing unusual had occurred. And indeed this is so. It is better to camp at the river for the night, so you pitch your tent and have breakfast. In the afternoon you take the raft and work carefully down stream about a quarter of a mile to an island where you know there are imperial pigeons. Your cook is at his wits' end how to give you a little variety, and is no less anxious than yourself that you should be successful. When you come back, you find two elephants have arrived at the other side, and one of them seems likely to remain there. His companion, a large elephant, has been across several times to show him how simple it is, but he is not to be persuaded. It is strange at first to see an elephant crossing a river out of his depth. He does not swim but walks along the bottom, holding his trunk up vertically so that it emerges above the surface and he can breathe. Of course if the water is too deep he has to swim. Meanwhile the mahout swims over on the surface, guided as to the whereabouts of his charge by the tip of the trunk, and as the animal gradually rises up he settles down on his neck. Persuasion in this case having had no effect, the timid elephant is chained to the staunch one and dragged into the water; this succeeds admirably for a time, but as the animal in front gets into deeper water he loses his power and is promptly hauled back by the smaller one. This and various other methods having been tried with the same want of success, as a last resource a scheme that hardly ever fails is put into execution. An elephant will not face fire. As darkness comes on twelve torches are prepared and are distributed among twelve men. The plan is to lead the animal to the water's edge, then at a given signal to light the torches, the twelve men bearing down on the stubborn *hathi* (elephant) who, in his terror, plunges into the

stream and crosses to the other side. There the other elephant waits to soothe and reassure him. In this case the plan is excellently arranged, every one knowing exactly what he has to do. The torches are quietly lighted behind bushes, the signal is given, and with a yell the twelve torch-bearers rush out and converge on to the stubborn elephant. There is a trumpet from the elephant, a yell, like one of fear, from the torch-bearers, and the torches cease to advance. About six of the bearers depart as they came, only more rapidly, while the others take to the river as the last place that irate *hathi* is likely to visit. The *hathi*, after trying to find his tormentors, escapes to the jungle and is not recovered for fifteen days.

From Kant river you pass on to Saikan, where at one time it was proposed to have a military outpost. If you camp here, you can pick up a few snipe on a particularly unsavoury bog behind the village, on the left of the tract going east. Passing on, you descend from the Saikan plateau to the Ben Kyaung river, about thirty miles east of the Kant river. It is a tributary of the Salween, which it joins a few miles below Kenghkam. The village of Kenghkam is on the right bank of the river, beside the ferry. The palace of the Kenghkam myose is in the village, and consists of several bamboo huts rather larger than the ordinary, surrounded by a high stockade of teak posts planted close together so as to screen the potentate and his doings from the gaze of the vulgar crowd. The river is crossed on two dug-out canoes, side by side, with a bamboo platform across. It is about 450 yards from bank to bank, and the last of a row of islands lies just above the crossing. The bullocks are driven first into the river and on to the island, where they rest before they are driven on to the left bank. In this crossing they frequently get lamed by knocking their legs against the ridges of rock, which lie just under the surface of the water. Above the island there is a series of smaller ones, and the whole river becomes a rapid, the roar of which can be heard for miles. Here, and in many other out-of-the-way corners of Burma and the frontier States, there is scenery far lovelier than any that is visited year after year by hundreds of globe-trotters. The want of hotels, steamers, trains, and Pullman cars, is an additional charm, and long may it last. If one of your bullocks goes astray at this crossing, there is a venerable old gentleman in the village, who, if given sufficient rice, will place a few grains on each of two posts at the ferry, and will then chant prayers for the speedy return of the missing animal. Its return depends not so much on the earnestness of the prayer as on the quantity of the rice. A liberal gift of the staple article of food ensures the speedy recovery of the animal.

From the Ben Kyaung to the Salween river, a distance of about thirty miles, through the small hamlets of Nahok, Wantong, Hoko, and Nannoo, the marching is pretty stiff, and some difficult bits have to be got over. This stretch is, however, being rapidly improved by the Public Works Department. At some places the path is so narrow that, if you meet another bullock train, one of the animals is almost certain to be jostled over the edge and hurled down into the ravine. When this happens you send some men down to recover your kit and the saddle—

the bullock has carried his last load. From the plateau between the Ben Kyaung and the Salween there is an almost continuous descent of 3000 feet to the Takaw ferry on the latter. Here the bed is about 500 yards from bank to bank, but during both the cold and hot seasons the actual stream rarely exceeds 200 yards. The current runs about six miles an hour and, except at the ferry, the river is dangerous, being studded with angry-looking rocks. Whirlpools also are of frequent occurrence. The bullocks are taken over on platformed canoes, as the strength of the current is apt to drive them on to the rocks below. They go over three or four at a time, and the loads follow. The boat is poled a considerable distance up the right bank, then, as it is shoved off into the stream, six or eight experienced men paddle vigorously, and ultimately bring you to land on the far side, about as far below your original starting-point as you poled up. In the rains, when the river is swollen, the crossing is no mean undertaking, and you may have to wait several days before you can attempt it. From the Salween river there is a very hard march up to Waihang, the next camping-ground. In places it is quite impossible to ride, and it is as much as you can do sometimes to haul your pony after you.

Waihang is a noted tiger camp, and several lives have been lost there. At night you can hear tigers roaring almost within a stone's throw from the tents, across a small stream in almost impenetrable jungle, but they hardly ever show themselves. Here the bullocks are all tethered together, a large circle of brushwood is built round them, and a stock of wood is collected and kept inside the ring. When night comes on the brushwood fence is set on fire, and the bullockmen, who sleep inside with the cattle, take it in turns to keep watch, and feed the fire. At intervals they let off most blood-curdling yells which, if they do not drive prowling tigers away, certainly spoil most effectually your night's sleep.

From Waihang, through Hseng Möng, Nammo-ma-lin, Nam-lai-pin, and on to Möng Ping, the travelling is worse than anything previously encountered. If you wander along some of the beds of the smaller streams crossed during these marches, you come upon several hot sulphur springs. They might be mistaken for pools of ordinary river water left on the edge of the streams as these fall, were it not for the sulphurous smell and the intense heat of the surrounding rocks. Sometimes you find these smaller streams suddenly disappear down a large natural well and apparently get lost in the earth. Follow the general line of the valley, however, and farther on you discover them bubbling out again, perhaps half a mile from where they were last seen. Again, in some places you find a natural basin of considerable area completely surrounded by an unbroken range of small hills, leaving no apparent outlet for drainage. The whole basin, perhaps, is bare of vegetation, with the exception of a rank patch at the bottom. Go down into this, first firing a shot into it and wearing leather gaiters as a precaution against snakes, and here again you find a hole, and hear water dripping far below. This may be one of a series of basins all similarly formed, all draining into the earth, and at the end of the series you find the accumulated drainage running out of the hillside in a little stream.

The grandeur of the jungle as a whole, the stately forest, the graceful and feathery clumps of bamboo, the orchids, the ferns and the running streams, all have their fascinations, and when at last you look down on the Möng Ping plain with its cultivation, its houses and its bazaar, you experience a feeling of regret and disappointment that all these beautiful things come to such an abrupt and every-day ending.

A pretty sight, often to be seen at night in the hot weather, is a jungle fire. You see it start perhaps far below you and gradually widen and widen, at the same time eating its way higher and higher up the hillside. You hear the roar of it as a clump of dry bamboo or patch of high grass is reached and devoured, dry stumps of trees being charred and left glowing red, as they are fanned by the night breeze. By the morning light all that is visible is a charred hillside. This is not all, though. These stumps smoulder and smoulder all day and for many days, and the surrounding jungle gets drier and more withered as the season advances. With the evening breeze the smouldering tree is fanned into life, live sparks are carried away till at last one of them, finding a favourable resting-place, starts another night's destruction. All through the hot season these fires consume large tracts of grass and forest, and you are lucky, if, at one time or another, you are not compelled in the night to shift your camp hurriedly to avoid one.

At Möng Ping the water-festival is in progress. If you wait you will see Shans at their best. The men are picturesque, some of the women are pretty, and all are dressed in holiday garb. When you have seen enough of it, you can visit the gold mines on the banks of the Nam Ping. The precious metal is scarce and hard to get, and the mines are only worked spasmodically by the natives themselves.

If you feel inclined, you can continue your journey to the walled city of Kengtung (properly pronounced it is Kaing-toong), about fifty-six miles farther east. It is a particularly interesting city, and is not far distant from a tract of country which, at the present time, is causing considerable political anxiety. If you do go, do not stay too long. The roads are bad in the good seasons; avoid them in the bad, or another little cross may be added to the yearly increasing number which dot the side of the track—all there is to show where strong men have been beaten.

ANTARCTIC EXPLORATION.

During the last half-century numerous expeditions have opened up the interior of Africa, traversed Asia in nearly every direction, reducing the unknown tracts to very narrow limits, penetrated into the centre of the South American continent, and added considerably to our knowledge of the Arctic regions. But round the South Pole there still remains an area larger than that of Europe which has been seen by man only at a few marginal points. The unknown areas of the Polar regions are exhibited in Dr. Mill's diagram, on p. 52 of vol. xi., and since that was drawn a huge cantle has been cut away from the darker shade, repre-

senting the Arctic area, by the successful voyage of Dr. Nansen, while at the other Pole exploration has made little progress since the days of Ross.

A map of this region (there is one in vol. x. facing p. 66), of which so little is known, shows that it is roughly bounded by the Antarctic circle. Turning to the Arctic regions (see map facing p. 246, vol. xiii.), we see that the corresponding circle skirts the northern coast of Iceland, passes south of Tromsö and other Norwegian ports, includes a considerable portion of Siberia, and, leaving the Yukon goldfields not far to the south, cuts through Great Bear Lake and Davis Strait. Within it lie numerous European and other settlements, and many lands and islands that have been more or less thoroughly examined by scientific expeditions, or are annually visited by whalers. These vessels constantly resort to Spitzbergen, Franz Josef Land, and other places in as high a latitude as Ross attained in the south as far back as 1842.

Naturally the physical conditions of the two regions have been the principal cause of the great difference in the progress of exploration at these extremities of the earth. While the Antarctic is a continent—most probably, at any rate—surrounded by a vast extent of open ocean, the North Polar area consists of sea and islands closely hemmed in by large continents, and at no great distance from long civilised countries. A comparatively short voyage brings a vessel from the midst of the ice-pack to ports where provisions may be obtained and repairs executed, and during the summer assistance may be often obtained when necessary from whalers along many parts of the ice margin. Far greater have been the difficulties in the way of Antarctic exploration. In the early years of the century Sydney, Cape Town, and Buenos Ayres, in about lat. 35° S., were the nearest European settlements. It was then a formidable undertaking, especially before the introduction of steam, to take a vessel among the packs and bergs of the southern ice, so far from any place of refuge, and whence there was no escape for the crews by travelling over ice, in case the vessel were crushed; and therefore it is no wonder that the earlier navigators, Cook, Bellingshausen, Weddell, Wilkes, Dumont d'Urville, and Ross, touched only here and there at the edge of the pack or the islands and outlying points of the Antarctic continent. Even now the nearest point to which vessels can repair, the Falkland Islands, is farther from the South Pole than Edinburgh is from the North Pole.

During the latter half of this century, however, steamships have been brought to great perfection; better sanitary arrangements and improvements in the preserving of provisions have rendered a prolonged sojourn in the Polar regions far less fatal to human life than a march through the malarious districts of Africa, and much has been learned by long experience in navigation among ice-floes and sledge-travelling over pack-ice and ice-capped lands. Consequently the thoughts of enterprising travellers and men of science turn to the largest unknown area of the globe, which by its extent alone promises a fertile field of research in all departments of science, and which contains the Southern Pole of the earth's axis of rotation and the southern Magnetic Pole. Since Ross

attained the highest southern latitude in 1842 scarcely any progress has been made. Messrs. Donald and Bruce on the Dundee whalers, Captain Larsen of the *Jason*, and Captain Kristensen and Borchgrevink of the *Antarctica*, did what they could to add to our knowledge of the geography, geology, and zoology of these southern lands. As these expeditions were primarily commercial, they were not able to accomplish any great amount of scientific work, but the results obtained have stimulated the desire, long felt by all connected with science, for more thorough measures. At present there seems more probability that the numerous discussions that have been held of late will have a practical outcome in foreign countries than in our own. A Belgian expedition sailed last summer, and a German expedition may be counted on. Also Mr. Borchgrevink, a Norwegian, is to conduct an expedition equipped by Sir George Newnes.

It were much to be regretted if Great Britain, which has played no mean part in the exploration of both regions, should now stand by while other nations are winning laurels in the southern seas. The question has frequently been brought forward during the past twenty years, and resolutions have been passed at meetings of the British Association, by the Royal Geographical Society and other bodies, and the scientific aims of such an expedition have been set forth at meetings of this Society by Dr. Murray, Dr. Buchan, and other authorities. Still nothing has yet been accomplished towards the realisation of the scheme, and therefore, on February 24th, a large body of representative men met together in the rooms of the Royal Society, London, for the purpose of arousing an interest in the question, by setting forth once more the numerous advantages in all branches of science that may be expected from an exploration of the Antarctic, and of stating how they considered an expedition should be organised. Sir John Evans presided, and, besides British men of science and explorers, there were present Dr. Nansen and Lieut. Johansen, Dr. Neumayer, of the Deutsche Seewarte, who came over expressly to attend the meeting, and the Italian Ambassador.

The proceedings were opened by an address from Dr. Murray, who touched on all the various phenomena that may with advantage be studied by a South Polar expedition. He alluded to the low pressure and low summer temperature, spoke of the great ice barrier, 150 to 200 feet above the water, along which Ross sailed for 300 miles, and argued that, though land had actually been seen only at intervals along the edge of the enormous mass of ice, yet that the form and structure of the icebergs, 1200 to 1500 feet thick, indicated that they had been built up and had flowed over an extensive land surface. The fragments of rock dredged up by the *Challenger* were indicative of continental land, and Borchgrevink and Bull had brought back specimens of mica-schists and other continental rocks from Cape Adare. A piece of chert, containing *Radiolaria* and sponge spicules, picked up by Dr. Donald on Joinville Island, and fossil coniferous wood and shells, similar to species in Lower Tertiary beds in Britain, which Captain Larsen collected on Seymour Island, pointed to a much warmer climate in past ages. Naturally, Dr. Murray paid special attention to the hydrography of the region under

discussion. The few soundings taken in that part of the world seemed to show that the ocean gradually shoaled from great depths up towards the Antarctic continent. The temperature in the greater depths varied between 32° and 35° F., and was not very different from that of the bottom water in tropical regions. Probably the warm tropical waters, driven southwards along the shores of South America, Africa, and Australia, are cooled by the strong westerly winds in the great southern ocean, and, having a high salinity, sink below the surface between the latitudes of 45° and 56° S. They are then drawn northwards, to make good the waste caused by evaporation and south-flowing surface-currents, or southwards to supply the place of the ice-cold currents drifting from the Antarctic area. The warm underlying water is evidently a powerful agent in melting the huge table-topped bergs of the southern hemisphere. All these questions call, however, for further investigation. So also does the marine life of these seas, which is very abundant and chiefly remarkable as exhibiting a close resemblance to that of the Arctic region. The shore fishes, and, moreover, all classes of marine invertebrates in the southern area have their representatives—often identical in species—in the North Polar waters.

Following Dr. Murray, the Duke of Argyll spoke of the opportunity afforded by the Antarctic ice-cap, much larger probably than that of Greenland, of studying the movements, if any, and the general conditions, of such enormous sheets, and the light the knowledge thus acquired would throw on glacial geology in past ages. Sir Joseph Hooker, the sole survivor of Ross's expedition, discussed the formation of the pack, and the origin of the barrier. All that is known of the latter is that it rests in great part upon a comparatively shallow ocean bottom. Probably it abuts on land, possibly on an Antarctic continent; but nothing could be seen from the crow's nest of Ross's vessel above the terminal ice-wall. To settle this important point Sir Joseph Hooker recommended the use of captive balloons.

Dr. Neumayer spoke of the great benefit the higher geodetic theories would derive from a gravity survey of the South Polar area, and upon the connection between gravity and terrestrial magnetism. Nothing is known of the secular variations of the magnetic elements south of 50° S. lat., though the information is urgently needed for the construction of charts required in navigation. Towards the south of the Australian continent are two foci of local intensity, and in close connection with their situation and that of the Magnetic Pole is, no doubt, the fact of the greater prevalence of magnetic disturbances on the Australian side of the Antarctic continent, but the reason of their distribution is still unexplained.

Dr. Buchan discussed the bearing of atmospheric pressure in the Polar regions on Professor Ferrel's theory of atmospheric circulation. Facts of observation, he said, do not support the theory of the existence of a low barometric pressure, or an eddy of winds, in the neighbourhood of the North Pole. In southern high latitudes there is certainly a belt of low pressure extending as far as 55° S., but farther towards the Pole southerly and south-easterly winds begin to increase in frequency, and

from 60° southwards they become the prevailing winds, implying the existence of a more or less pronounced anticyclone overspreading Antarctica. Did the low pressure area extend over the Pole the strong west-north-westerly winds, blowing vortically round and towards the Pole, would pour down the abundant aqueous vapour they had collected in the southern ocean in continuous rain, sleet and snow, which no explorer, however intrepid and enthusiastic, could possibly face.

Sir Archibald Geikie stated that the specimens of granite, volcanic rocks and fossiliferous limestone brought home from Graham Land might have come from any old mountain group in Europe or America. The fragment of chert, already referred to, raises the question whether older Palæozoic rocks are present in the Antarctic regions. It would be of great interest to discover such rocks *in situ*, and to ascertain whether their fossils agree with those in similar deposits in lower latitudes, or, whether, as far back as early Palæozoic time, any difference of climate had begun to show itself between the Polar and other regions of the Earth's surface. The speaker also referred to the volcanic phenomena apparently connected with the volcanic ring that encircles the Pacific, and is continued south of New Zealand in the Auckland, Campbell and Macquarrie groups. Dr. Nansen, Mr. Sclater, Sir Clements Markham, and Professor D'Arcy Thomson also addressed the meeting.

Much valuable work could, no doubt, be accomplished by private enterprise, and various schemes have from time to time been discussed, and last year the Royal Geographical Society proposed to organise an expedition equipped by private contributions. But it is generally felt that the work should be a national one, and that an expedition on a thoroughly adequate scale can only be organised by the naval authorities. It must, Admiral Sir W. J. Wharton remarked, be under naval discipline, and officers and men would be eager to join it. During the last four years repeated efforts have been made to induce the Admiralty to consider the question, but, under present circumstances, it was thought inadvisable to spare the necessary officers. Now an appeal has been made by the Royal Geographical Society to Lord Salisbury, who is favourably disposed towards the enterprise, and will give due consideration to the representations laid before him. There is, then, at the present time, good reason to hope that this country may maintain in the far southern seas its old prestige as the foremost maritime nation of the world.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

New Members.

At a meeting of Council held on March 25, the following gentlemen were elected members of the Society:—

Johnstone, H. B. Neilson, Wm. Thomson, R. B.

Lectures delivered in March.

On March 10th, Dr. James A. Greig described his "Journey from Manchuria overland to Moscow" to the members of the Society in Edinburgh. Professor C. G. Knott presided, and Sir Thomas Clark moved a vote of thanks to the lecturer.

Another lecture was delivered in Edinburgh on March 24th, by Mr. C. E. Borchgrevink, who spoke of his forthcoming Antarctic expedition. Dr. John Murray presided.

A meeting at Glasgow on March 1st, presided over by Mr. R. S. Allan, was addressed by the Rev. Hugh Callan, of Catrine, his subject being "The Lands and Peoples of the Balkans."

Mr. Borchgrevink also visited Glasgow on March 21st, the meeting being presided over by Sir W. Renny Watson.

At Dundee, on March 22nd, and at Aberdeen, on the 23rd, the members assembled to hear Mr. Borchgrevink. At Dundee the chair was taken by Lord Provost M'Grady, and at Aberdeen by Mr. James Spence.

Lectures in April.

On April 5, Mr. W. Ogilvie, Dominion Land Surveyor, will lecture in Edinburgh on the Yukon region.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Denmark.—According to a calculation made on July 15, 1896, the area of the kingdom, including the islands, is 9,371,829 acres, or 14,643 square miles—the peninsula of Jutland containing about 9649 square miles, and the islands 4994. Since 1888 the area has been increased through the drainage of swamps by 6800 acres, chiefly on the islands. Of the above area 6,931,728 acres are arable or meadow land; 698,916 are laid out in gardens, plantations and nurseries, or are covered with forest; 219,550 are occupied by railways, roads, buildings, etc., while the remainder is fen, heath, bogs, and other waste tracts. The last class has been much diminished since 1888, raising the total gain of profitable land, with the reclaimed marshes, to 221,717 acres.

Among the areas reclaimed from the sea during the last decades are one of about 4700 acres at Kolindsund in Jutland, and another of about 9500 acres at Lammefjord in Zealand, both of which now produce grain and grass, and contain numerous farms and houses. 1,644,369 acres in Jutland, and 1,225,427 on the islands are planted with cereals, principally oats, rye, and barley; and since 1888 the area devoted to the cultivation of beet has increased by 68 per cent. Plantations of firs have been extended from 100,600 to 159,100 acres, chiefly by utilising waste lands in Jutland.—*The Danish Export Review*, Jan.

The Rhone Glacier.—The Swiss Alpine Club, assisted by the Swiss Gesellschaft für Wissenschaften, has, since 1874, been executing a thorough investigation, with the object of compiling a topographical map on a large scale and based on a reliable triangulation, and to forward the study of glacier movements. Four series of stones painted different colours were arranged on the glacier—a row of red

stones at a height of 8400 feet, yellow at 7910 feet, green at 6100, and black at 6000. The movement of the glacier is very slow, nowhere exceeding 27 inches in a day or 820 feet in the year; the minimum annual movement is little more than a yard. At the edge the velocity is a hundred times less than in the middle, owing to the resistance offered by the rocks. The downward movement diminishes from the snow limit to the end of the glacier, where it is almost *nil*. The analogy between flowing water and moving ice is well shown in the case of rapids caused by the contraction of the bed. The yellow row of stones passed between 1881 and 1885 down a cascade 1300 feet high, lying between the Belvidere and the Saas. After passing the fall, the row remained in regular order on the glacier. The velocity in the cascade was 820 feet in the year, whereas above it was only 360 feet. If water formed the cascade it would descend in nine seconds, while the ice takes four years to reach the bottom, and therefore the ratio of the velocity of ice to that of water in this case is 1 : 14 millions.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xxiv, No. 7.

ASIA.

The Malay States.—*The Perak Government Gazette* of October 8th contains a report by the lately appointed Resident-General, Sir F. A. Swettenham. Having travelled since June nearly 7000 miles in and about the Malay States, he had gained much knowledge of what was being done by private individuals, as well as by the Government. European planting in Negri Sembilan and European mining in Pahang especially attracted his attention. Planting, particularly the cultivation of Liberian coffee, has made great strides in the last two years, the progress being most marked in Negri Sembilan, where minerals are probably scarce. Mining, on the other hand, is being developed in Pahang, a State which is deeply in debt, and has hitherto caused a drain on the resources of the Malay States, having little revenue of its own to meet the cost of improved administration. Now enough work has been done in the solid rock to show the resources of the country, and, when communications have been improved, Pahang will probably justify its ancient reputation as a mineral district.

As long ago as 1892 the Perak Government determined to carry out a large irrigation scheme in Krian, the greatest rice-producing district in the Protected States. Last year the work was commenced, and about 400,000 dollars will be expended in distributing an unfailing water supply to about 50,000 acres of rice land. In other parts of Perak small schemes of irrigation have proved successful, benefiting the Malay cultivators and raising the value of the land. The Government receives a return on the capital by the imposition of a water rate.

Several important works have been constructed, of which the most noteworthy is the great Selangor-Pahang road, which, starting from the present terminus of the railway at Kuala Kubu, crosses the main range of the peninsula at a height of 2700 feet, passes Raub and traverses the fertile plains of Gâle, and finally runs into Kuala Lipis, the headquarters of Upper Pahang. This road, 84¾ miles in length, which will be completed this year (1898), will be the making of Pahang. It penetrates the heart of the country and taps some of the most valuable districts, passing close to the Raub mines and not far from Bentong, to which a branch will, it is hoped, be shortly constructed.

Though the prospects of the Malay States were never brighter than at present, in spite of a considerable fall in the prices of tin and Liberian coffee, it is undoubtedly advisable that the number of products should be increased. Besides tin, there is also gold, and its exploitation will probably take care of itself. The

Government has had to encourage agriculture, and will probably find it well to continue the policy. The climate and soil are suitable for most tropical products, and when a new crop has been once successfully tried it is widely taken up. Probably there will be before long a large demand for india-rubber, of which many species are indigenous, while others were introduced from America by Sir Hugh Low. Excellent tea has been grown in Perak, Arabian coffee has been produced on the mountains, and, when a cart-road has been carried into the highlands dividing Perak from Pahang, other paying agricultural products will probably be introduced.

The Sources of the Red River of Tonkin.—In 1895 M. C. E. Bonin, whose explorations in Western China were noticed in vol. xii. p. 473, while at Tali, preparing for his journey, made an excursion to the source region of the Red river. According to a common report the floods to which the river is subject are due to the melting in summer of the snows of Tibet. But the Mong-hoa region in the heart of Yunnan, where the river rises, is quite out of reach of the nearest snowy mountains of Tibet, the Hsueh Shan, and the floods, which commence in May at the change of monsoon, are probably due to the south monsoon which carries clouds from the Gulf of Tonkin to the highlands of Yunnan. The clayey soil, bare of trees, cannot retain the rain that falls on the plateaus of Yunnan, and therefore it flows at once into the river.

The Red river rises in the highlands between the Chinese villages of Hsia-kuan, Chao-chau, and Monghoa-ting. This triangular mass sheds its waters north-westwards towards the Mekong by the river Yang-py, north-eastwards to the Yang-tse-kiang, and southwards to the Red river. The principal source of the river is known in its upper course as the Mong-hoa-ta-ho, then as the Ta-yang-kiang, next as the Yuan-kiang at the town of the same name, and lastly, as the Li-hoa-kiang between Yuan-kiang and Man-hao, where it becomes navigable. The river of Mong-hoa is formed by the union of several small streams, chief among them being the river of Shin-shue, and the torrent which springs up at the foot of the small Chinese post of Wa-fong-sang at an altitude of 8530 feet, and is considered by the inhabitants of the country to be the principal source of the Red river. From Wa-fong-sang the river descends to Shuin-tien, 6070 feet above sea-level, and, after receiving the Shin-shue river and divers other small streams, runs across the plain of Mong-hoa in a bed fully 20 yards broad, always in the direction from north-west to south-east, which it preserves to its mouth.

Another river, mentioned by Colquhoun as contributing to form the Red river, flows past the walls of Lao-fung-hsien, between Yunnan-fu and Tali, where it is spanned by a monumental bridge of seven arches. It is here 77 yards broad, and, when M. Bonin crossed it, was swelled by the rains and had a velocity of about 6½ feet a second. The Teng-tse, as it is called at Lao-fung-hsien, there flows southwards in a valley between two chains of mountains which have a height of 5410 feet on the east and 6200 on the west, while the river at the town lies at an altitude of 5118 feet. These heights compared with those on the Mong-hoa river show that the Teng-tse is only a secondary branch of the Red river.—*Bull. de la Soc. de Géographie*, 2^{e} Trim., 1897.

AFRICA.

The Ruvuma Country.—Dr. F. Stuhlmann reports, in the *Mitt. aus den Deutschen Schutzgebieten*, Bd. x. Heft 3, the results of his explorations on the German-Portuguese boundary, south of the Ruvuma mouth. The country, he says, consists of three clearly defined regions—the low, narrow, coastal zone, the

inland plateau, and the Ruvuma plain. The coastal zone extends from the shore to the edge of the plateau, which, at Meningene, close to the sea, passes northwards round Cape Delgado, and at Kionga turns towards the Ruvuma. Along the coast, as everywhere in East Africa, lies a coral reef—masses of limestone evidently raised in recent geological times, and rendered by weathering still more jagged than those in the sea. The fact that a broad reef at the level of low water follows the trend of the coast justifies the assumption that formerly land, consisting of raised masses of coral, filled up the interval, and subsequently were washed away by the erosive action of the waves. Even now the shore shows signs of the encroachment of the water, and if it is true, as some people affirm, that the land south of Cape Delgado is extending, it may be that the Equatorial stream, which impinges on the African coast during the larger half of the year, washes land away north of the cape, and deposits it in the sheltered corner to the south.

The plateau rises from the coastal zone to a height of 400 to 430 feet, and is continuous with the Makonde plateau on the northern side of the Ruvuma. A proper elevated plateau it is not, but only the kind of country everywhere noticeable in East Africa beyond the low coast region, and the escarpment is conspicuous along the Ruvuma solely because the river has excavated its broad alluvial valley through the land. The soil is, in general, sand, and laterite is to be found only towards the Ruvuma. In some deep clefts rounded flints were seen, and at one spot a conglomerate of coarse sand and rounded flints—evidently the rock from which the loose flints came. Probably the formation is alluvial, and similar to the strata of late Jurassic origin found farther north.

A plain five or six miles broad is sunk in the plateau, its soil consisting of dark-grey alluvial clay. Through this the Ruvuma (or Luvuma, but not Rovuma) has cut its way in a fairly straight course, keeping to the edge of the plateau on the north. The stream is, perhaps, 800 to 1000 yards broad, and is full of constantly moving sandbanks and reedy islets. In February 1895, though the water was fairly high, there were only eight to twelve inches of water at a distance of one hundred yards from the bank. The quantity of water is very variable and does not appear to depend on the season. Nevertheless the Ruvuma is probably navigable almost throughout the year by river steamers of small draught, though not without difficulty, owing to the sandbanks.

Except Cape Delgado and the other coral cliffs, which are densely clothed, the coast lands are covered with thin steppe bush. By far the larger part of the plateau is overgrown with impenetrable bush ten to sixteen feet high, through which even a blade of grass can seldom force its way upwards. Bamboo is here the most common form. At the edge of the plateau, by the Ruvuma plain, the wood becomes more luxuriant, and in some spots has almost the appearance of a tropical forest.

AMERICA.

Mineral Resources of Alaska.—A sum was assigned in the fiscal year 1895-96 to the U.S. Geological Survey for the purpose of investigating the mineral resources of Alaska, and the same amount is to be granted annually. In the first year Dr. George F. Becker, assisted by Mr. C. W. Purinton, began an examination of the gold deposits. At the Treadwell mine on Douglas Island, near Juneau, and other workings in the vicinity, the precious metal is found in slates of comparatively recent sedimentary origin, probably of Triassic age, penetrated by a heavy dyke of diorite or similar basic rocks. The yield is only ten or twelve shillings a ton, but the profits are great, owing to the enormous quantity of ore. At Silverbow Basin,

three miles north of east of Juneau, at Sumdum, five miles to the south-east, and at Seward, fifty miles to the north, there are also auriferous veins, as well as on Admiralty Island. On one of the islands of the Shumagin group there is a large amount of ore said to yield thirty-three to thirty-six shillings a ton, and auriferous quartz has been found on other islands. Large fields of good brown coal exist on the eastern shore of Cook Inlet.

In the second year the Yukon and its upper tributaries were visited by a party under the guidance of Mr. J. E. Spurr. The gold-bearing rocks were found to occur in a definite belt extending from the boundary to the Lower Ramparts of the Yukon. All the gold of Alaska is alloyed with a small quantity of silver. Native silver is frequently found, and also native lead and copper, and platinum has been reported from several localities. Coal was found not far from the gold-producing districts.—*Bull. of the American Geogr. Soc.*, vol. xxix. No. 3.

The Enchanted Mesa.—Mr. F. W. Hodge has described this singular elevation in the *National Geographic Magazine* for October 1897, and has contributed a note on the tradition relating to it, in the *American Anthropologist* for September. The Enchanted Mesa, situated in lat. 34° 54′ N., and long. 107° 34′ W., rises perpendicularly from the plain to a height of 430 feet. The tradition of the Acoma Indians, first recorded by Mr. C. F. Lummis some twelve years ago, is that their forefathers lived on this tableland, until one day, when most of the inhabitants were at work on the fields below, an immense mass of rock fell down from the cliff, and destroyed the only trail that led to the summit. The few old women who were on the summit perished of starvation, while the Indians on the plain settled at Acoma. The catastrophe must have occurred before the advent of the Spaniard, for Coronado found the Indians living at Acoma. In 1895, Mr. Hodge examined the talus piled about the foot of the great south-western cleft where the ancient pathway wound up to the summit, and found numerous fragments of pottery of a very ancient type. Last year, in July, Professor W. Libbey succeeded in reaching the summit by means of a life-saving apparatus, but failed to find any relics there. Later in the year, Mr. Hodge, accompanied by Major G. H. Pradt and others, climbed the Mesa with the help of a ladder and ropes. He found several fragments of ancient pottery, and a white stone axe, which show that the Mesa was at one time inhabited, and confirm the tradition of the Indians. A rude monument of stones, also, stands at the edge of the eastern cliff. The summit has been swept and carved by the winds and rains of centuries since the ancestors of the Acomas made it their home, and all traces of their dwellings must have been carried away. Though there had been a storm the day before Mr. Hodge's ascent, no water remained on the surface, the whole having streamed over the brink, carrying fresh detritus to the accumulation round the base of the Mesa.

The Chonos and Guaitecas Archipelagos.—Dr. Dusen visited these islands, which lie off the south-west coast of Chile, between 47° and 46° S. lat., in the earlier part of last year. The Chilotes, who visit Melinca, the only permanent settlement, divide the whole collection of several thousand islands into two nearly equal divisions, calling the northern the Guaitecas and the southern the Chonos islands. By geographers, on the other hand, the name Guaitecas has hitherto been applied to the comparatively smaller islands near, and chiefly to the west of, Melinca, while all the numerous large and small islands between the Tuamapu channel and the Taitao peninsula have been called the Chonos archipelago. All these multitudinous islands and rocks are very mountainous, though no peak on the Guaitecas group reaches a height of 1300 feet. They are not volcanic, like the Andes, and

generally take the form of extended ridges. They all consist of mica-schist, like the coast mountains of Chiloë, Llanquihue, and Valdivia. Imbedded in the rocks is quartzite, and at some spots Tertiary deposits and later formations of sandstone and conglomerate are found. Traces of a glacial period are very conspicuous. Probably in former ages a huge ice-sheet extended up to the crest of the neighbouring Andes, and every summer, when the water collected beneath it, thrust ponderous masses of ice against the Guaitecas and between them to the Pacific Ocean. This is shown by the striated and polished rocks so numerous in many places, especially near the coast, and on the eastern side, which had to bear the impact of the ice. Glacial pot-holes are very numerous. Very different from the pot-holes, which are sunk perpendicularly, are the grottoes washed out by the surf. Among them is the famous Caleta de las Momias, where the pilot Yates discovered the dried remains of the long extinct Chonos Indians.

The forest is very similar to that at Puerto Montt, but *Fitzroya Patagonica* is replaced by *Libocedrus tetragona*. The timber is small, all the old trees having been felled. The smaller vegetation closely resembles that of Western Tierra del Fuego.

On his return journey, Dr. Dusen visited Chiloë, and climbed the Huaimaano mountain, 1056 feet high, near Ancud. Tierra del Fuegian plants grow on its summit.—*Globus*, Bd. lxxii. No. 14.

MISCELLANEOUS.

The **Third Italian Geographical Congress** will be held at Florence from the 12th to the 17th of April.

It is expected that the **Congo Railway**, from Matadi to Stanley Pool, will by this time be open for traffic.

On April 16th, the **Société de Géographie et d'Archéologie** at Oran will celebrate the twentieth anniversary of its foundation.

The new capital of the Brazilian province of Minas Geraes, **Bello Horizonte**, was formerly inaugurated by the State President on December 12th. Hitherto Ouro Preto has been the capital.—*Deutsche Rundschau*, Jahrg. xx. Heft 6.

A terrible outbreak of the volcano **Lamongan** in the Probolingo residency, Java, took place on February 6th. Much damage was done to the Government plantations, more than 800 acres being totally destroyed. The Lamongan is as a rule quiescent, but eruptions have occurred from time to time, the most notable being those of 1840 and 1859.—*Deutsche Rundschau*, Jahrg. xx. Heft 6.

The Duke of the Abruzzi, whose ascent of Mount St. Elias was recorded in vol. xiii., will start this summer on an **Arctic expedition**, accompanied by his adjutant Cagni and Professor Guido Cora, with the object of reaching the Pole. He will pass next winter in Franz Josef Land, and in the following summer push forward with sledges and boats. He intends to take with him a number of Eskimo.—*Deutsche Rundschau*, Jahrg. xx. Heft 6.

A **Canadian North Pole Expedition** is in prospect. At a recent meeting of the Quebec Geographical Society Captain Bernier unfolded his plan. He proposes to take much the same route as Nansen from the North Siberia Islands, which he will reach by way of Bering Strait, but he will leave his vessel at the eightieth parallel and make for the Pole with sledges. Captain Bernier is an experienced navigator, and is well acquainted with the Arctic ice.—*Canadian Gazette*, Feb. 17th.

A contract has been made with a New York firm for the construction of a railway from **Guayaquil to Quito.** From Quito the line will start at an elevation of some 9400 feet, and will ascend about 600 feet to Santa Rosa. In other points it will attain to heights of 12,000 and 12,300 feet, the last being on the slopes of Chimborazo. The difficulties of construction will therefore be enormous, and the engineering works numerous, including no fewer than 830 bridges. The line will be 400 miles long, and is estimated to cost £3,106,500.—*L'Universo*, Feb. 28th.

Among the articles in *The Annals of Scottish Natural History* is one by Mr. Harvie-Brown on The Minor Faunal Areas, which contains many useful remarks on the limits of such areas and some curious cases of migration. Mr. Macvicar contributes a paper on the Flora of Tiree, which comprises 320 species. The island, 18,828 acres in area, is remarkably low, most of it being less than 30 feet above sea-level; it was formerly wooded. There are several other papers of interest in the January number of the *Annals*, as well as a large number of zoological and botanical notes.

The correspondent of the *Times*, writing from Suakin, January 26th, gives a detailed itinerary of the route from **Kassala to Tokar** by way of the Khor Baraka. Proceeding from Kassala in a north-easterly direction he notes as follows:—The Khor and Wells of Ali Gebrat, 20 miles from Kassala; Khor and Wells of Aribdab, 40; Khasm Aribdab, 48; Khor Logueb, 56; many wells in the Khor, principal wells, 75; Khor Kourbieh, 90; Khor Baraka, and wells of Kolik, 96. In the Khor Baraka the best-known wells are at Jebel Sotai, 118 miles; Khor Anseba, 127; Khor Aderehib, 139; Hakalte, 148; Ambakta, 156; Tebetet, 165; Langheb, 186; Ferak Selim, 192; Debetewatib, 210; Temeren, 223; Tokar, 236 miles from Kassala.—*Times*, February 14, 1898.

In vol. xiii. p. 656, the performances of **ice-breakers** in Russia were recorded. They seem to offer equal advantages in Canada. The *Canadian Gazette* of Feb. 24th reports that an ice-breaker, constructed to run between Port aux Basques, the terminus of the Newfoundland Railway, and Sydney, Cape Breton, has, pending the completion of the line, been put on the route from Placentia to Sydney, and has been running since November with unfailing regularity, breaking with ease through 15 inches of solid ice and keeping open the port of Sydney, which hitherto has been closed in winter. Possibly more powerful vessels of the same class could break through the ice-barriers of the St. Lawrence, or at any rate keep the channel open much later in the year than at present.

The aeronauts **Godard and Surcouf** contemplate proceeding this year to Spitzbergen with a balloon of 10,000 cubic metres capacity (about 353,000 cubic feet). This will be filled with pure hydrogen gas, and will be surrounded by twelve smaller balloons, which will act as reservoirs to make good the loss of gas in the larger balloon. M. Godard believes that the buoyancy will be sufficient to keep up a load of 11½ tons for a period of sixty days, during which, at the rate of four metres a second (nearly nine miles an hour), he would be able to travel nearly 13,000 miles. The party will consist of seven persons, including a chemist, a meteorologist, and a doctor. Possibly M. Godard will wait to see whether any news is obtained this summer of the fate of Andree, before starting on his expedition.—*Himmel und Erde.*

The latest researches of the **Prince of Monaco,** briefly recorded in the January number, are given in greater detail in a reprint from the *Comptes Rendus* of the Académie des Sciences, which contains a sketch of the Princess Alice bank. The

trawls, tangle-bars, etc., brought up a large quantity of organisms, some new to science. At the Azores a turtle, *T. Caretta*, weighing only 1½ lbs., was caught, and the presence of so young a specimen is singular, as in the archipelago the conditions seem to be unfavourable for the reproduction of this chelonian. A gigantic amphipod, measuring 5½ inches, was caught at a depth of 2890 fathoms, of a new genus, and belonging to the family of the *Lysianassidæ*. From a depth of 690 fathoms, between Pico and São Jorge, the nets brought up a large number of mud-balls as large as plums, so fragile that they fell to pieces on being taken out of the water. They are probably of organic origin.

As a result of the Prince's efforts to establish meteorological stations in the Atlantic, two centres of observation have been created in the Azores through the instrumentality of Captain Chaves. One of these is at San Miguel, and is connected with Europe by cable. The other, on Flores, will probably be soon in contact with the outer world by a cable to America; its altitude is 400 feet above the sea, and it is exposed on all sides. The observations at San Miguel and Flores have already enabled Captain Chaves to correct some of the curves of the movements of cyclonic centres drawn in the Weather Bureau at Washington.

NEW BOOKS.

The Dialect and Place-Names of Shetland. Two Popular Lectures. By Jakob Jakobsen, Doctor of Philosophy, University of Copenhagen. Lerwick: T. and J. Manson, 1897.

In the *Samlinger til det Norske Folks Sprog og Historie*, published at Christiania in 1838, there appeared an article which may be rendered "Geographical and Historical Notices concerning Orkney and Shetland," in which a number of the place-names of Shetland are localised and briefly described, it is understood, by the late Professor P. A. Munch of Christiania. These place-names formed the subject of an elaborate study at a later date by that accomplished scholar, in a series of articles under the title "Geographical Elucidations of the Scottish and Irish Place-Names occurring in the Sagas" (*Geographiske Oplysninger om de i Sagaerne forekommende Skotske og Irske Stednavne*), printed in the *Annaler* of the Royal Society of Northern Antiquaries, Copenhagen, 1857. Articles on the subject (*Om Sproget paa Shetlandsöerne*), by the late Arthur Laurenson, Lerwick, and K. J. Lyngby, appeared in the same publication for the year 1860. The local dialect and nomenclature have from time to time engaged the attention of the curious among local antiquaries and others since then, but no further very serious effort has been made towards the elucidation of the subject in a scientific way until Dr. Jakobsen turned his attention to it.

A native of the neighbouring Danish isles of Feroe (where the old Northern tongue is still preserved in a diluted form closely allied to that formerly prevailing in Shetland), and himself an earnest student of philology, Dr. Jakobsen was eminently qualified for the task to which he set himself, and which he enthusiastically and successfully accomplished, entirely relying upon his own discoveries, and working out his own independent solutions without help from, or reference to, any previous authorities. He went from Copenhagen to Shetland in 1893, and in the course of that year, and of the two following years, visited every district of the country, even the almost inaccessible island of Foula, conducting his investigations with great assiduity, eliciting much valuable information pertinent to his inquiry, and extracting many almost obsolete words and idioms of the old tongue from the

older inhabitants, with rare persistency and skill. The result of these investigations is embodied briefly in the book before us, containing (1) a disquisition on the old Shetland dialect, and (2) an inquiry into the derivation and meaning of the place-names.

The treatment of both branches of the inquiry is extremely interesting, forming, as it does, an important contribution to Northern philology for the general student, and at the same time a repertory of local language and usages, local names, local rhymes, riddles, and colloquialisms, which must prove of lasting interest, especially to natives.

In the opening lecture the author traces the early history of the islands, especially in relation to their connection with the mother country of Norway, gradually leading up to the main theme, and giving descriptive examples of the local terms and expressions applicable to fishing and local customs, to persons, moods, colours, and pursuits, all possessing a strongly "Norn" or Norse flavour, from the times of the Scandinavian ascendancy, and all clothed in a quaint humour which can, of course, be most keenly scented by those who are conversant with the home-life and vernacular speech of the people. The ancient place-names, all likewise clearly and distinctly Norse, which are stamped on every spot on land, and by the sea-shore, remain with only slight variations, or modifications, from age to age ; and the revelation of their primal forms and significance, often unintelligible on the surface, is one of the most attractive features of the book.

The popular form of "lectures," in which the articles composing the book were presented, may have had their advantage at the time, but may also possibly to some extent impair their scientific value. This, however, is amply compensated for by the author's elaborate treatise, *Det Norönne Sprog paa Shetland*, since published as his graduation thesis for the University of Copenhagen, but which, issued in the Danish language, is for that reason scarcely available for the use of students in this country.

It is beyond the scope of this brief notice to enter into detailed criticism of Dr. Jakobsen's book. It may, however, be again safely affirmed that no investigator has ever attempted such an exhaustive study of the relics of the old Norse language in the northern Scottish isles, and no one probably will ever be able to rescue so many telling and significant illustrations of its character and extent. For the Norse ceased to be known after the middle of last century, though much of it is still current in the language of common life. But though this be so, and though Dr. Jakobsen claims to have discovered upwards of ten thousand words of the ancient speech still remembered by individuals, it is unquestionably the case that these are fast passing out of use, and, by consequence, out of memory, and are therefore hurrying on to extinction.

Such being the case, students of history and comparative language have reason for congratulation that these survivals, so industriously gathered, have been put on record in the present volume by a scholar so competent as Dr. Jakobsen. And it were to be fervently hoped that he might be induced, by sufficient encouragement, to publish his investigations in a wider and more comprehensive form in English. For the book deals with the subject only in the restricted form which the conditions of its issue imposed. The broad and general aspect of the surviving relics of the Norse in these isles could not be satisfactorily treated within the limitations of the book. Such a work indeed would be rather the province of the lexicographer, and an excellent beginning in that way was accomplished by the late Mr. Thomas Edmondston of Buness, when, under many difficulties, he issued in 1866 his "Etymological Glossary of the Shetland and Orkney Dialect." The vastly augmented stores of word-knowledge acquired by Dr. Jakobsen, with his capability

for accurate and scholarly definition, should now make possible the issue of a Dialect Dictionary of the Scandinavian Isles of Scotland which would be of lasting value.

Three Years in Savage Africa. By LIONEL DÈCLE. With an Introduction by H. M. STANLEY, M.P. With 100 Illustrations and five Maps, from original Photographs, Sketches, and Surveys by the Author. London : Methuen and Co., 1898. Pp. 503. Two Appendices and Index. 21*s.*

From Mr. Stanley's introduction we learn that "Mr. Dècle, though domiciled in England, is a Frenchman by birth and parentage, and comes from a good family. From his earliest youth he exhibited an aptitude for travel."

In 1890 the French Government intrusted him with "one of those scientific missions about which we have heard rather frequently from continental travellers." He was to go to South and East Africa to study their ethnology and anthropology.

"On his return from Africa, however, Mr. Dècle was received with marked coldness by both the French Government and the French press. He was reproached with having been too partial towards the British administration in the various countries he had travelled in, and especially with having been too biassed against the French *padres* in Uganda, and having charged them with political intrigue. Another cause of the censoriousness of the French was his staunch support of Mr. Cecil Rhodes' African policy." As a matter of fact, he went, as Balaam, to curse, and remained to bless.

He has been the first to unite the four zones of African exploration in one long continuous journey of 7000 miles—*i.e.* from the Cape to Uganda, and then to Mombasa on the East Coast. Mr. Stanley ends his introduction with the following words :—"With this rapid glance at Mr. Lionel Dècle's personality, unique journey, and its vivid record, I heartily recommend the narrative to English readers for its intrinsic interest, and the greatness of the achievement." We are glad to be able to agree with Mr. Stanley that the journey was unique, and to warmly commend the book to our readers. The author certainly is proficient in the art of observation, and he knows also how to eliminate from his story the needless repetitions and redundancies of other travellers. The sketches are very good, as also the photographs and the original maps.

"I will say that the chief impression I gathered from my long journey is that Great Britain possesses the very best portion of Africa from the Cape to the Nile, that she alone has justified her right to be in the country by developing every spot where the Union Jack has a right to fly, and she alone understands how to colonise ; and if one considers the gigantic work that has been carried out under the ægis of her flag within the last ten years in the heart of Africa, comparing it with the work accomplished by the Portuguese and the Germans, it will be found that England has, within these ten years, accomplished ten times as much as the Germans are ever likely to do within the next fifty years, although the German East African colony has already cost to the German taxpayer (the yearly expenditure comes to over £300,000, so that about three millions have been already spent) more than the whole of the British possessions north and south of the great African continent have cost to the British Government. But what impressed me most was the genius, the indomitable energy, and the greatness of the conceptions of Mr. Cecil Rhodes, Mr. H. M. Stanley, and other Englishmen who have left wherever they have been the imprint of their great minds, and who have never hesitated to support their schemes with money and with their lives,—men, in fact, of whom every English-

man ought to be proud, and whose names will live for ever in the history of Africa and of the world."

Our author's views on missions and the slave-trade will not meet with very much appreciation; but they should be studied with care by those who are interested in such matters, for there is a great deal of sound common-sense, and we are not sure that more good would not be done by following his ideas than is now accomplished. Mr. Dècle presented all the "curios" to the French museums. "The cost and transport of these curios came to over £1000, but I only received from the French Government 4000 francs (£160) towards the cost of the whole of my journey, and on my return I received no thanks and still less reward. If, following the example of one of my countrymen on the Niger, I had pretended that Colonel Colvile had tried to poison me, I should most likely, like this traveller, have been rewarded by a governorship." What a commentary on French action this is! Another warning, if we would only take it. The whole volume from the first page to the last is full of valuable information, and the powers of observation which Mr. Dècle possesses are of a very high order. It must be read to be fully appreciated, and those who are going out to Africa will find in it a mint of most useful information. We will not quote tit-bits, although there are many which would serve us in good stead. Read the book, and you will not be disappointed, and you will at the end congratulate the author on his pluck, literary talent, and honesty, and wish that a few more such explorers (which he does not claim to be) existed.

We wish his book a wide circulation, and the author a new fit of travelling mania.

Hindu Manners, Customs, and Ceremonies. By the Abbé J. A. Dubois. Translated from the Author's later French MS. and edited by Henry K. Beauchamp. Oxford: The Clarendon Press, 1897.

The author of this work was a very remarkable man. Born about 1765, he was ordained in 1792, and then went to India as one of the missionaries of the Missions Etrangères. He laboured in the Dekkan for over thirty years, both as a missionary and as a philanthropist, and his success in planting agricultural colonies and in encouraging vaccination—a much suspected innovation in those days—was acknowledged by the East Indian Company, which awarded him a special pension for his good services. On his return from India in 1823, he became Director of the Missions Etrangères, and lived till 1848.

The history of this book also merits a passing notice. The Abbé had prepared a MS. setting forth his observations of the manners, customs, religion, etc., of the natives with whom he associated, and he made it over in 1806 to a Major Wilks, who took more than a year to find out its worth. He did, however, in 1807, submit it to the authorities; and Lord William Bentinck, promptly recognising its value, purchased it for about Rs.8000, and sent it home to England for translation and publication. It lay neglected in the Company's offices in London some nine years, but was at last published in 1816. In 1815 a Mr. Campbell at Madras found a MS. copy of the Abbé's work; and assuming that the authorities had never heard of it, he proposed to publish it in Madras. On preparing to do this, he wisely came to the conclusion that the Abbé should have an opportunity of revising his former work. To this the Madras Government agreed; the MS. was returned to the Abbé, who in the meantime had accumulated a huge store of more information and materials, on the strength of which he practically rewrote the work. The Madras Government despatched the revised MS. to the Board of Directors in England, who probably never looked at it, being satisfied with the publication of the edition which had originally been submitted to them. Now, after a lapse of some

seventy years, a translation of that extended and revised edition is for the first time published, and so made available for the public.

It is very difficult, without making long extracts from the work, to give the reader an idea of its contents or of the erudition of the writer. It refers to the condition of India and the Indians south of the Vindhya range between the years 1792 and 1823, and describes castes and subdivisions of castes, from the highest Brahmin to the lowest Pariah, ceremonies of all sorts relating to births, deaths, and marriages, expulsion from and recovery of caste, the ideal and the actual life of Brahmins, etc., their costumes, ornaments, rules of etiquette, philosophy, astronomy, magic, and the like, their theology, religious ceremonies, temples, feasts, orgies, processions, etc. In brief, the work is a quarry from which the statesman, historian, philosopher, philanthropist, missionary, and student can carry away abundant and most valuable material with which to prosecute his studies of that time and locality. The Abbé does not write with a view to effect. He simply records what he has seen and observed; and as he abandoned his European habits and lived with the natives for many years, and won their unreserved confidence, implicit reliance may be placed on what he sets forth. To unrivalled opportunities for, and unwearied devotion to his work, he added a keen and eminently judicious acumen, with the patience and charity of his profession. As a storehouse of accurate and detailed information regarding the people of Southern India this book has no rival.

Much, however, has happened in Southern India since 1823, and the ultra-conservatism of the people has in some measure failed to resist the impact of Western civilisation, so it has been the task of the translator to add notes which indicate when the Abbé's remarks describe customs, etc., which are now obsolete or changed. To the attentive reader, however, the wonder is that there has been so little change; and he will begin to realise how little real progress has been made in the work of civilising India, and what are the initial difficulties which lie in the way of those who have undertaken the task. The Abbé, with all his experience, and notwithstanding all the kindness he had received from the people, had but the poorest opinion of the Hindoo, and practically despaired of his ever being raised from the degradation and misery in which he found him. Even of Christianity he mournfully said, "Let the Christian religion be presented to these people under every possible light . . . the time of conversion has passed away, and under existing circumstances there remains no human possibility of bringing it back." If he hoped for any success for Christianity at all, it was among the degraded castes, who, he expected, would not hesitate to change their faith from interested views. Time has shown how correct was his appreciation of the situation. More than a century has elapsed since he began work in India, and now the Christians do not number one per cent. of the population, and nine out of ten, if not ninety-nine out of a hundred, converts are men of low caste.

The Abbé was much impressed with the excellence of the system of government introduced by the British in their Indian possessions, and passed a well-deserved eulogium on the *personnel* of those sent to rule over peoples and tribes whose *vis inertiæ* and incredible conservatism render the work of government one of extreme difficulty and danger.

L'Algérie. Par Maurice Wahl, Docteur ès lettres, Inspecteur-Général honoraire de l'Instruction publique aux Colonies. 3ème édition, revue et augmentée. Paris: Félix Alcan, 1897. Pp. 442. *Price* 5 *Frs.*

Some few details are added to our geographical knowledge of Algeria by a perusal of this volume, and many of the subjects with which Mons. Wahl deals

will be read with interest by others than his own countrymen. His statistics of the trade and population of the great French colony demand attention, and the rapid rise from insignificance of such seaport towns as Bougie, Philippeville, on whose harbour upwards of twenty million francs have been expended, and Algiers, which from its coaling facilities ranks third after Marseilles and Havre, is instructive. One thing which has tended more than others to increase the importance of the seaports is the wonderful development of the road system, only commenced about 1830, by which and by the railways the supplies of corn, fruit, olive oil, and cattle from the interior are brought to the coast for exportation. Agriculture has made great strides under the French, and although their superiority over the natives is emphasised unnecessarily, it is curious to learn that in 1893, out of an agricultural population of about 3,000,000 natives and 200,000 Europeans, the farm-buildings and material of the former were valued at 86,000,.000 and 4,000,000 francs respectively, as against 300,000,000 and 23,000,000 of the latter! But the author may forget that, except as an "antique," the value of the Berber farming plant, which is of the same pattern as used by the Phœnicians, B.C. 600, cannot be taken into consideration, while the tents of the natives are worthless as compared with the neat cottages of the French settlers.

Although facts, and certainly dates (p. 79), seem sometimes a little mixed, the accounts of the progress of the country under the successive *régimes* of the Phœnicians and Romans, with the retrograde movement under the Vandals and Turks, is well told. On the interesting question of the origin of the Berber race little additional light is thrown, but ethnologists should read the opinions quoted of General Faidherbe, Procopius, and the Mussulman historian Ibn Khaldún. The unity of the Berbers as a race does not seem to have been recognised by ancient classic writers; but, whether hailing from the north of Europe or the Land of Canaan (p. 57), they are surely the true aborigines of North Africa, and to this day are to be found in Algeria, Morocco, and elsewhere, living apart from the rest of the population in curious white villages perched on the hillsides. Here they preserve the same customs, manners, and, to some extent, the same language as has characterised them since, probably, some ten centuries before the Christian era.

The author separates Algeria into two grand orographic divisions—the highlands of the Tell to the north, and those of the Sahara to the south. He minutely describes these mountain systems, apologising quaintly for their humble altitudes, nowhere so much as 10,000 feet—"une imperfection géographique, un vice d'architecture"—and enters into detail regarding their climate, rainfall, and capabilities of development as wood-growing districts. His close acquaintance, too, with the coastline from Oran to Bone, together with the less accessible tract of country which lies behind the line of mountains that runs parallel to the sea, makes this portion of the book attractive to geographers. His estimate of the climate as "reviving and stimulating" is optimistic, especially to any one who has travelled there in summer, though it must be confessed his description of the dreaded south wind (p. 21) will be appreciated by all who have felt it.

Considerable space is devoted to the plans for irrigation, and there is a most graphic account of boring for and discovering water in the Sahara, when, after twenty-two days' work, a stream, giving four thousand litres per minute, burst out from the desert sands, at sight of which it is hardly necessary to recount that "tout le monde s'embrassa." Military readers will be interested in the careful narrative of the operations, including (p. 138) a vivid account of the siege and fall of Constantine in 1836, which covered a period of some twenty years before the French were masters of the country; for Algeria was not only the training ground for Generals Canrobert, Pelissier, St. Arnaud, and others who took part later in

the Crimean war, but was also the field in which Abd el Kader, that prince of patriots, won renown. During these troublous times it is not surprising to hear that *perfide Albion* put in her oar, and while one smiles at the excuses made for annexation and the extension of the Republic, an apt simile will be found in ours for the enlargement of the Empire. Those who seek for the cause of recent troubles on the frontier in the overthrow by Mussulmans of a Christian power in Europe will be confirmed in their belief by the effect the collapse of France in 1870 had upon the Algerians; insurrections broke out on all sides, and were only put down by the same bloodthirsty measures which had previously succeeded. The French are, probably, the worst colonisers in Europe, but the chapters on this subject are worth reading, and show with what earnestness, according to their lights, they set about the task in Algeria. Here, too, we may take a lesson in the government of Orientals in a country where the conquerors do not hesitate, for the public good, to repress by the severest measures such crimes as incendiarism and the propagation of diseases capable of being kept under control, both of which offences are viewed in the most venial light by the Arab population. To people, also, acquainted with the East, the repression of begging would appear an impossibility, but in Algeria the placards which constantly meet the eye of the traveller, "la mendicité est défendue dans cet arrondissement," are by no means an empty form, and the laws against this and the above-mentioned offences are successfully carried out by legislators unharassed as we are by irresponsible and ignorant critics. The enforced civilisation created by the French makes us turn our eyes farther west and compare it with the semi-barbarism of such towns as Tangier, Rabat, Mazagan, which might under more favourable conditions have become depôts and places of export for corn from a country which is capable of being the granary of Europe. M. Wahl, however, is reticent on the possible future of Morocco, which country, anyway, is not predestined to become an appanage of France, as was Algeria through the fact impressed upon us early in the volume, that the meridian of Paris cuts it in half, while Nemours is in the same longitude with Cherbourg, La Rochelle, and Bayonne!

A good index and a map would be useful accessories to this work, and will perhaps appear in a future edition.

L'Italie: Géographique, Ethnologique, Historique, Administrative, Economique, Religieuse, Littéraire, Artistique, Scientifique, etc. Paris: Larousse, 1897. Pp. 608. *Price 5 fr.*

Following *La Russie*, treated in the same encyclopædic fashion, this volume analyses Italy in every possible way, and with 243 engravings and five maps, sets before the reader a most comprehensive account of the Peninsula. A novel and interesting feature is the introduction of portraits from photographs of typical citizens of the various provinces of Italy, illustrative of an ethnological article by M. Zaborowski on the Races of Italy. He remarks that the ancient Romans did not create a unity of race in Italy, and that few descendants from them exist to-day. Just as, in his opinion, modern Greeks have not a drop of blood of the ancient Greeks, so the modern Italians are chiefly descended from the slaves of the ancient Romans who existed in enormous numbers (some rich citizens possessing as many as 20,000), and who were of very varied and foreign extraction. The consequent abundant variety of race in Italy has been very beneficial, and has enabled Italians to excel in politics, science, literature, art, and industry. M. Georges Michel furnishes some instructive economical tables proving the poverty of Italy, such as the following:—

	Wealth in millions.	Wealth per head in francs.	Trade in milliards.	Crops in milliards.	Land cultivated. hectares.	Yield per hectare in francs.
Great Britain,	218,000	6225	162	9	22 m.	400
France, . .	214,950	5600	80	8	24 m.	300
Germany, .	160,925	3500	60	4	23 m.	100
Russia, . .	108,575	1625	30	4		
Italy, . .	73,825	2500	14	3	14 m.	70

The Pioneers of the Klondyke: being an Account of two years' Police Service on the Yukon. Narrated by M. H. E. Hayne, N.C.O. of the N-W. Mounted Police, and recorded by H. West Taylor. London: Sampson Low, Marston, and Co., 1897. Pp. xii + 184. *Price* 3*s.* 6*d.*

Mr. Hayne went up with a detachment of twenty men, the first police sent to the Yukon mining district. They made the voyage from Seattle to St. Michaels in a steamer of 1000 tons, running considerable risks from fogs and the overloaded state of the vessel, and then ascended the Yukon on a river steamer in nineteen days to Fort Cudahy. Though, perhaps, not beset with such serious dangers as the routes over the passes at the head of Lynn Canal, the journey is evidently not exactly a pleasure trip. A large part of the book is taken up with the experiences of the author's party, the building of a station, travelling by boat and sledge, etc.; but he gives also a description of the rush to the Klondyke and of the mode of mining in these high latitudes. The winter is the mining season, and not the summer, as has been frequently stated. The little book well depicts the manner of life on the Upper Yukon, and contains some amusing incidents. A useful warning is given of the risks incurred by starting for the Klondyke without adequate means—not less than £200, excluding the fare from Europe to Canada. Some of the photographs are good, especially those illustrating the breaking up of the ice on the river.

The Gold Fields of the Klondike. Fortune-Seekers' Guide to the Yukon Region of Alaska and British America. By John W. Leonard. London: T. Fisher Unwin, n.d. Pp. 216. *Price* 2*s.* 6*d.*

Though treating of the same region, this book is of quite a different character from the last. After notices of the marvellous luck that has befallen some of the miners, and extracts of official reports on the mineral wealth of the country, details are given of the routes to Klondyke, methods of mining, mining regulations, etc. No mention is made of the Stikine-Teslin route, though it has long been discussed and is now likely to become the most frequented of all. There is some useful information in the book, but more might probably have been added by one writing from personal experience. The map of Alaska entered among the illustrations is unfortunately absent, at least from the copy sent to the Society.

Imperial Defence. By Lieut.-Col. Sir George S. Clarke, K.C.M.G., F.R.S. London: The Imperial Press, Limited, n.d. Pp. xv + 251. *Price* 5*s. net.*

This book was written in anticipation of the Jubilee of last June. It is intended "to show what the Empire is, and how it has been built up, to point out

alike its immense potential strength and its points of weakness, to lay down definite principles of defence based on the experience of great wars, and to plead for an organisation in harmony with such principles," and for this purpose it is addressed not only to the inhabitants of the United Kingdom, but to all Her Majesty's subjects in all quarters of the world. The story of the building of the Empire is sketched without political party bias in the first chapter, after which we have chapters devoted to the all-important subjects of our trade, our navy, and our army. The concluding chapter sets forth the author's views on Imperial organisation, in which he has fairly well anticipated the lines which are now generally accepted as feasible on that much-debated question. The volume is not overweighted with figures and statistics, but on the other hand a sufficiency of these has been given so as to enforce the view which the author advocates, and to set before the reader the present *status quo*. If there are any of our readers whose memory needs to be refreshed on these points, or who have not followed the course of the discussions during the Jubilee time on the subject of Colonial and Imperial Federation, this book may be recommended to them. It is a very readable and fairly accurate presentation of the views of many, who look forward with confidence to a general colonial and imperial federation of the Empire in the future, but who do not wish to embark hurriedly into premature negotiations, which might alarm, and would certainly disturb and harass our colonies, and would probably end in defeating the purpose for the accomplishment of which they were originated.

With Nature and a Camera: being the Adventures and Observations of a Field Naturalist and an Animal Photographer. By Richard Kearton, F.Z.S., Author of *British Birds' Nests*; *Birds' Nests, Eggs, and Egg-collecting*, etc. Illustrated by 180 Pictures from Photographs, by Cherry Kearton. 8vo. London, Paris, and Melbourne: Cassell and Co., Lim., 1897. Pp. xvi + 368.

This is an entertaining, brightly written, and beautifully illustrated book. Over a third is devoted to an account of a visit to St. Kilda, where the author made many interesting observations, not only on the birds, but also on the people. The charm of the author's narrative, which is simple and direct (after the manner of most field-naturalists), is enhanced by Mr. Cherry Kearton's fine photographs. Not a few of them have a somewhat extrinsic interest, inasmuch as they were taken in situations and circumstances the imagining of which makes one's flesh creep. The rest of the book is devoted to gamekeepers; nests, eggs, and young; the sleeping-places of birds, the haunts of sea-birds, bird-catching, duck-decoying, and the like. These chapters contain many careful observations, some of which are novel, and their chatty style leaves one with the feeling of having had a delightful talk with a sharp-eyed and sympathetic field-naturalist.

La Face de la Terre (Das Antlitz der Erde). Par Ed. Suess. Traduit avec l'autorisation de l'auteur et annoté sous la direction de Emmanuel de Margerie avec une préface par Marcel Bertrand, de l'Académie des Sciences, Professeur à l'Ecole nationale supérieure des Mines. Tome I^{r}, avec 2 cartes en couleur et 122 figures dont 76 exécutées spécialement pour l'édition française. Paris: Armand Colin et C^{ie}., 1897. Pp. 835 + xv.

Das Antlitz der Erde, by E. Suess, originally published some thirteen years ago, has taken rank among the standard works on geology. That not every one of the views put forward by the author has met with general acceptance must be

admitted, but there is no difference of opinion as to the very valuable services the work has rendered to the advancement of geology, and is destined to render for many years to come. Strange to say, no English translation has yet been published, and although the original is written in a comparatively simple style, not too commonly found in German scientific books, yet two large octavo volumes are sufficiently formidable to strike terror into many a heart. Those who are able to read French have now an excellent substitute in the translation, the first volume of which was issued last year. M. de Margerie's name is a guarantee for careful workmanship; and, indeed, wherever we have compared the translation with the original, we have found it perfectly accurate. The evident pains bestowed on the rendering have resulted in a work which, as far as elegance of language is concerned, reads like an original production. M. Bertrand has contributed a very interesting preface, in which he determines Suess' position in the evolution of geological science. The translators have added numerous references to recent literature, and valuable notes to bring the book up to date. A large number of new illustrations and sketch-maps will prove very welcome to readers. As the original appeared in 1885, it would be of great interest to know how far Suess still holds the views at that time put forward, but on this point the translators give no information.

Anthropologische Studien über die Urbewohner Brasiliens, vornehmlich der Staaten Matto Grosso, Goyaz, und Amazonas (Purus-Gebiet). Nach eigenen Aufnahmen und Beobachtungen in den Jahren 1887 bis 1889, von Dr. Paul Ehrenreich, Berlin. Mit zahlreichen Abbildungen und Tafeln. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1897. Pp. 165. Bibliography and 30 plates, 96 in text and 9 plates of vertex curves. *Price* 25 *M.*

All anthropologists owe a deep debt of gratitude to both the author and publishers of this most interesting and beautifully illustrated work. It fills a great gap in our knowledge of the races of Central South America, and, as these races are fast dying out, it is a matter for congratulation that Dr. Paul Ehrenreich, under the greatest difficulties, has been able to make such an important contribution to anthropology as we find in these pages.

The publication has long been delayed, the author having had first to work out the ethnological and linguistic material which he had obtained.[1] Again, the author was loath to publish, because he considered the material at hand to be small; but we do not agree with him. To examine with great care, under such conditions as he did, nearly two hundred persons is no small undertaking. Also, he thinks that the present method of using anthropological "measurements" is faulty, and he feared that young observers might use his material in a way he did not think scientifically just, and so impose upon the laity. He is rather hard on these "eifrigen Jünger." He also criticises Virchow, Ratzel, Kollmann, and Topinard, although he thanks them for the rich teaching and stimulation to work which they have provided him.

At last, we are glad to say, he does publish, because of the interest the measurements, photographs, etc., possess in being the first taken in Central South America. And we are glad he does so, and are also glad of his introductory chapters, "Ueber die Aufgaben und Methoden der physischen Anthropologie und ihre Anwendung

[1] See *Beiträge zu Völkerkunde Brasiliens*, Berlin, 1891. *Ueber Eintheilung u. Verbreitung der Völkerstämme Brasiliens*, 1891, Petermanns Mitt., Bd. xxxvii. 581-89, 114-124. *Südamerikanische Stromfahrten*, Globus, Bd. lxii., 1892.

auf die Ethnologie," and "Die amerikanische Rasse und ihre anthropologische Stellung.'

He has strong views on both subjects, which deserve the grave consideration of all anthropologists. We have to point our readers to the book itself for their scope and nature.

Turning to the author's anthropological observations themselves, they are of extreme value. No less than 184 individuals were measured, and are described in detail, as well as some fifteen skulls and skeletons. The observations are accompanied with splendid photographs and drawings, so well produced that we greatly regret the loss of many others lost or spoilt during the author's travels. Seventeen tribes were examined, and Dr. Ehrenreich describes the various difficulties he had in getting the natives to submit to the operation. One young lady jumped overboard to escape being measured. Others, however, were quite interested, and tried their hands at measuring the doctor's horses and dogs.

Kleinasiens' Naturschätze, Seine wichtigsten Tiere, Kulturpflanzen und Mineralschätze. Von KARL KANNENBERG. Berlin: Borntträger, 1897. Pp. xii + 278. *Price M.* 14.

This volume is at once a product and an expression of the new trend of German interest (and interests) towards Turkey, and is the work of an enthusiastic Turkophile who sees golden visions of a Turkish Renascence under German auspices. But this gives the book brightness and actuality; and though the illustrations and text are less directly related than is usual, we welcome both. In a large series of good process blocks the characteristic types of landscape and vegetation, of villages and inhabitants, are brought before us, and one thus gets a very graphic view alike of geologic marvels and disappearing forests, of rudely terraced peasant villages or scattered pastoral ones. The armed and mounted shepherd amid the fallen domes and capitols of a classic city, or the wilder Kurd of the uplands in his goat's-hair tent, the peasant on his primitive thrashing-floor, the Zaptieh, who with difficulty keeps order between these rival social formations, pastoral and agricultural, are all here; and the book for the sake of these illustrations alone might fairly be recommended to any one who wishes to get a rapid general impression of the types and aspects of the ruined East. The text is that of a reference volume of readable encyclopædia articles on the animal and plant types, and on the mineral productions of Asia Minor, alike in their natural and their economic aspects. It is most akin, and much indebted, to Hehn's classic *Kulturpflanzen und Hausthiere*. Omissions might be pointed out, and the book in various ways is one which might be notably improved for a second edition; but this, however, it quite deserves to reach.

Thessalien und Epirus: Reisen und Forschungen im nördlichen Griechenland. Von Dr. ALFRED PHILIPPSON. Berlin: W. H. Kühle, 1897.

Dr. Philippson, whose geological and geographical researches in the Peloponnese are well known, journeyed over northern Greece in 1893 under the auspices of the Geographical Society of Berlin, to whose Journal he communicated the result of his travels in a series of interesting papers which appeared from time to time between the years 1895-1897. These papers he has now collected in the present volume, under the belief that, in view of recent political events, they may interest a wider circle of readers. One thing is certain, that the wild regions traversed by our author are not likely to be revisited for a long time by any other competent

traveller. Much of the ground traversed by Dr. Philippson was practically virgin land, so far as geological research is concerned, and even the geographical features were very imperfectly known. His work, therefore, is of special scientific interest, and the assiduity and pluck with which he conducted his studies are deserving of cordial recognition. For the first time we have a clear account of the geological structure and the geographical features of the mountains of Epirus and Thessaly, illustrated by a number of excellent orographical and geological maps and plates of geological sections.

North America. Vol. I.—*Canada and Newfoundland.* By Samuel Edward Dawson, Litt.D. (Laval), F.R.S.C. Stanford's Compendium of Geography and Travel (new issue). London : Edward Stanford, 1897. Pp. xxiv + 719. *Price* 15*s.*

In dividing the geography of North America, intended for British readers, into two volumes, it was natural to devote one to Canada and Newfoundland. In this volume, however, no summary of the leading geographical features of the continent is given, so we suppose it is deferred to the second volume. There is some reason to be glad of this, for the general part of this book is the weakest part. Dr. Samuel Edward Dawson is a charming writer, with a clear style, who never fails to interest. We feel that it is not in vain that he is a native of a land many of whose inhabitants speak French. The scenes of Canadian landscape and life have never been better described. A larger proportion of the volume is given up to history than is common in geographical works, but we do not regret this, as it is well told, and not well enough known in other British territories. The author's patriotism rings true and gives a pleasant tone to the book, which rarely jars.

We regret very much that Dr. Dawson had not a collaborator for the scientific side of the work, which is both meagre and unsatisfactory. There is no clear idea of the problems presented to the geographer in Canada, and consequently no adequate treatment of them. For this the general editor of the series must be held responsible. He remains anonymous, which should not be the case in so important a series of books as the first English compendium of geography.

Although the book is disappointing as a scientific work, it is still indispensable to those interested in Canada and Newfoundland. It presents the best as well as the most complete account we possess of what is perhaps the most promising part of our world-wide empire.

There are some excellent illustrations in the book, and a number of ordinary political maps wherein the reader can find places mentioned in, but in some cases with spelling differing from that of, the text.

Geografia Commercial de la America del Sur. Por Carlos B. Cisneros y Romulo E. Garcia. Entregas 1 y 2. Lima : Imprenta de la Escuela de Ingerieros, 1897. Pp. 100.

It is usually rash to decide on the merits of a work until the whole is issued. But these parts are complete in themselves, the first being introductory, and the second dealing with the commercial geography of the Argentine Republic. The object of the writer is to make known throughout South America the commercial products of each State with a view to promoting trade. This end the work is calculated to achieve, as it contains a large amount of the latest statistics. As we may have to speak of it again when the other parts have been issued, we shall not dwell more fully on its contents in the present notice.

Egypt. Handbook for Travellers. Edited by KARL BAEDEKER. 4th Remodelled Edition. Leipsic: Karl Baedeker, 1898. Pp. cciv + 395. *Price* 15 *M.*

The great increase of tourists to Egypt, and the fact that most of them belong to Great Britain or the United States, have called for a new edition of this admirable guide. There are other excellent guide-books for English-speaking tourists, but Baedeker's is so handy, besides being so reliable, that it still remains the favourite. An examination of the present "remodelled edition" satisfies us that no pains have been spared to make it at once full, accurate, and thoroughly up to date. If anything, it is rather too good for the average tourist, being amply sufficient for the most exacting Egyptologist.

To criticise its archæological details is out of the question, but we are glad to see that the remarkable rock tombs of Mereru-ka or Meri (at Sakkâra) and Nakht (at Thebes) now get the justice they deserve. The former had only a restricted notice in Baedeker for 1895, and was termed the tomb of Mera. The latter was not referred to at all in Baedeker for 1892. The tomb of Sen-nofer (at Thebes) ought also to have been marked with an asterisk in the present edition.

A distinct advantage of this "remodelled edition" is that the tourist has the whole of Egypt up to the Second Cataract in one volume, of convenient size, instead of in two volumes as formerly. He not only saves trouble by this but saves seven shillings.

Succinctly detailed in this volume, the delightful voyage from the First to the Second Cataract in Messrs. Cook's admirably equipped steamer has met with such success during the present season that a second steamer will soon be necessary. The famous rock temple of Abu Simbel, and the wild landscape and population above the First Cataract, leave imperishable memories. We notice that "the present military station and stopping-place of the steamboat" immediately below the Second Cataract is said to be "named Ankish," but on a very recent visit we found the military station was named Wâdi-Halfa and the stopping-place Tewfikieh—a flourishing town which this guide does not mention, nor is it shown on its relative map. In Mr. E. F. Knight's "Letters from the Sudan" (*Times*, April 1896) Tewfikieh is referred to as a "new town" occupying the site of a village known as "Dabroso, the bazaar supplying the Wâdi-Halfa garrison, which was raided by the Dervishes in 1888." The guide under review does not mention that Wâdi-Halfa is the terminus of the new Halfa Abû-Hamed and Bash Tenab railway line, 306 miles in length.

Illustrated with 22 maps, 55 plans, and 66 views, the general up-to-dateness of the volume is proved by its containing maps showing the new, scarcely opened, railway line from Nag' Hamâdeh to Luxor and Assuân—a line which, like that from Halfa, will immensely expedite tourist travel throughout Egypt.

Spain and Portugal. Handbook for Travellers. By KARL BAEDEKER. Leipsic: Karl Baedeker, 1898. Pp. lxxxvi + 618. *Price* 16 *M.*

The Peninsula has at last achieved the distinction of possessing a Baedeker's guide-book, and of having its extraordinary wealth of architectural, artistic, and historical places of interest described with all the precision and erudition with which the name of Baedeker is associated. The volume appears synchronously with the opening of the great through railway route (Sud Express) from Calais *via* Paris, Madrid, and Cordova to Gibraltar—a route which, begun at either end, will open up Spain to the tourist in a manner hitherto unknown.

Comparing this with other English guide-books, we commend its more portable form, whilst its 6 maps and 46 plans, and its elaborate description of everything worth seeing, leave nothing to be desired. We should have liked a little more emphasis

placed on the advisability of tourists (especially those visiting Spain for the first time) arriving in time for either Holy Week or the Fair at Seville, for very striking scenes are then witnessed, and Seville displays remarkable animation which she afterwards loses.

Ceylon. Von Emil Schmidt (Leipzig). Mit 39 Bildern und 1 Karte. Berlin: Schall und Grund, 1897. Pp. 323 + viii.

Professor Emil Schmidt of Leipzig visited Ceylon in 1896, and the book under review is the outcome of his journey. The author first gives a delightful description of the places he travelled through and the scenery of the country, which he traversed in different directions. Having thus made his readers familiar with the different aspects of the island at the present day, he gives a systematic account of what else seems worth knowing about Ceylon. A chapter on the history of Ceylon, based on the best English and native sources, is followed by a very interesting one on the population. The Veddahs, naturally, were carefully studied by him. One fact regarding this fast-disappearing race, mentioned by Schmidt, is very significant, and does not seem to be generally known: in the social scale of caste the Veddahs rank immediately below the highest caste. The author's account of the Rodias, who belong to the lowest caste, also contains some facts of interest to the ethnologist. The last chapter deals with the religions of Ceylon. Estimating the value of a religion, not by the number of its adherents, but by its moral influence upon them, the author feels unable to accord to Buddhism in its present form a high place among the religions of the world.

A. Hartleben's Kleines Statistisches Taschenbuch über alle Länder der Erde. Nach den neuesten Angaben bearbeitet von Professor Dr. Friedrich Umlauft. Wien, Pest, Leipzig: A. Hartleben's Verlag, 1898. Pp. 98.

We have often noticed this annual, and need only say that it is apparently carefully revised. We may remark that Labrador should not appear in the list of British colonies in America, as the greater part is included in the Dominion of Canada, while the remainder belongs to Newfoundland. Again, under Africa, we should not expect the Niger and British Central Africa to be included in the "etc." at the end, while Lagos and Zanzibar are mentioned. As usual, the most important contents of the book are also published in sheet form for the study wall. The *personnel* of the British Navy is, we believe, only 100,030, not 141,055.

Russland. Handbuch für Reisende von K. Baedeker, mit 14 Karten, 18 Plänen und 4 Grundrissen. Vierte Auflage. Leipzig, 1897.

This guide-book fully sustains the high reputation that the series enjoys as a compendium of carefully selected information and useful suggestion for tourists. Naturally it only covers the more frequented parts of European Russia, but there is a compact chapter on the Caucasus. The introduction, maps, and plans are excellent.

Verhandlungen des Zwölften Deutschen Geographentages zu Jena, 1897. Herausgegeben von dem ständigen Geschäftsführer des Centralausschusses des Deutschen Geographentages, Georg Kollm, Hauptmann, A.D. Berlin: Verlag von Dietrich Reimer (Ernst Vohsen), 1897. Pp. lviii + 252.

An excellent report of this meeting, from the pen of Dr. H. Wagner, who represented the Society at the Congress, was published in vol. xiii. p. 315. Not a paper was passed unnoticed, and therefore we need not here give a list of the contents of the volume before us. Several of the articles are of great interest, and some are illustrated by diagrams or charts.

NEW MAPS.

THE BRITISH ISLES. Keith Johnston's Geological Map of ——. New Edition, revised and extended by Alex. Johnstone, F.G.S.

W. and A. K. Johnston, Edinburgh.

This new edition of the well-known map by Sir Archibald Geikie has been brought up to date in regard to most points concerning which change of views have arisen since the publication of the earlier edition. The reviser has evidently consulted a considerable number of publications, and has embodied on the map, from these, nearly all the improved readings. The old editions were particularly useful as wall maps; but the present edition has in this respect also gone far beyond its predecessors. The colouring is bright and clear, each subdivision standing well out from those with which it is associated. A large number of useful sections, collected from a variety of the best sources, are engraved upon the map.

The map is accompanied by a small handbook, which contains much useful, as well as some original, matter.

Map of the Transvaal, showing the physical features and political divisions. By F. H. Hatch, Ph.D., F.G.S. Scale 1 : 1,570,000 (1 inch = 24·78 miles).

London: Stanford, 1897.

A Geological Map of the Southern Transvaal. By F. H. Hatch, Ph.D., F.G.S.

London: Stanford, 1897.

The author illustrates the geological structure by two horizontal sections, and gives the following as the succession of strata :—

SEQUENCE AND CORRELATION OF THE SOUTH AFRICAN STRATA.

	Cape Facies.	Transvaal Facies.	Probable European Equivalents.
Karoo System.	Stormberg beds,	Coal measures,	Lower Mesozoic.
	Kimberley and Beaufort beds,		
	Ecca beds,		
	Dwyka and Koonap beds,		
Cape System.	Zwarteberg series,	Gatsrand and Magaliesberg series,	Palæozoic.
	Dolomite of Damaraland,	Dolomite, Black reef,	
	Bokkeveld series—		
	Table Mountain sandstone,	Witwatersrand beds,	
	Clay shales,	Hospital Hill series,	
	Malmesbury and Namaqua beds,		
	Granitic and schistose rocks of South Transvaal, Swaziland, Kaap Valley, Lydenberg, Klein Letaba, Mozambique, and Mashonaland,		Archæan.

CHARTS.

PACIFIC OCEAN, Quarterly Current Charts for the ——.

Presented by the Meteorological Council.

A set of four charts, in which the currents and their velocities are indicated by the means employed on the charts of the Indian and Atlantic and Indian Oceans, previously published.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

LANDS AND PEOPLES OF THE BALKANS.

By the Rev. Hugh Callan, M.A.

(*Read before the Society in Glasgow, on March 1st.*)

There is probably no large part of the earth's surface richer in interest to the ethnologist and the geographer, as there is certainly none more perplexing, than the Balkan Peninsula. By reason of the numerous races and tribes occupying it and remaining more or less distinct—the numerous languages and dialects in use over it—the numerous creeds extant or traceable upon it (Pagan, Christian, Mohammedan)—the numerous and extraordinary historical vicissitudes in which it has participated, having been always the meeting-place or battleground between Asia and Europe—and, finally, by reason of the wild majesty of its scenery and the bewildering variety of its customs and costumes, it requires to be seen and studied by observation as well as by book. There the Cross and the Crescent meet, and struggle for adjustment. From the north and from the south the Cross has advanced in recent years, but while over Bosnia and Herzegovina, Southern Bulgaria and Northern Greece, the Crescent only faintly gleams now, over Albania, Old Serbia, Macedonia, Thrace (from the Adriatic to the Black Sea) the Crescent still shines clearly.

It is a vast region, full of mountains—especially in the west, 700 to 800 miles of mountain with hardly a break. It is one also full of mystery and melancholy. It is the true home of lost mighty causes—Greece, Rome, northern Barbarism, the Cross, the Crescent. Relics of paganism—beliefs and customs in vogue 3000 years ago—are traceable to-day lingering in mountain hollows, so long behind the life to which they belonged, and strangely grafted on to Christian or to Moslem usages, or far oftener to both. Hence there is no wonder that the average man of the Balkans should be neither a good Christian, nor a good Moslem,

nor a good pagan, but a strange mixed nondescript. To the mass of the people, whatever be their creed or race, there belongs a certain dogged moodiness or dreamy *dourness* which betokens a sad history, but also slumbering passions that may accomplish much if once roused.

Large districts of this region (*e.g.* Albania, Old Serbia, and Novi Bazar) are as unknown to the outside world as Central Africa. This is largely due to the land being mostly mountains, which in no place form a regular system, but which in every part rise in peaks from 5000 to 9000 feet high. The plains are but strips compared with the vast masses that enclose them, especially in the west. In the east there are many considerable plains, formed from alluvial deposits off the mountains or dried lake beds, *e.g.* between the Rhodope range and the Balkan proper (*Khodra*, ancient *Hæmus*), and the high central plateau of Sofia. Generally speaking, however, the plains are but *straths* or *carses* about a river, *e.g.* the Vardar in Macedonia, the Morava in Servia, the Narenta in Herzegovina, the Drin in Albania; or seaboard stretches, *e.g.* Marathon and Messolonghi in Greece. Hence outside influences cannot easily penetrate, but once in are apt to be forced to, or desire to, remain. Hence also there exist tribes, *e.g.* the Mirdites and other Albanians, surrounded, but never properly subjugated, still the same as they probably were 3000 years ago, whose common customs of to-day remind the traveller of scenes in Homer and the Bible.

May I be permitted to say that in nearly all these sad wild countries —certainly in all the wildest—if I dare not claim to have been a pioneer of civilization, at least I am so with that once despised biped, the bicycle? Socially and internationally the good it has conferred on Europe during the last fifteen years, growing under my eyes year by year, has been enormous. Travelling with a bicycle certainly leaves you more at the mercy of the natives, chance acquaintances and chance incidents, than by any other mode, but for that very reason it brings you closer to the actual conditions of life; and I think it makes you more alive to the configurations of the land. There is nothing interests man (be he Western or Eastern) like man; and it is because by being "yourself" amongst those simple peoples who are always "themselves," that life among them, despite its roughness, is for a Western so very refreshing. As they impressed me so have I expressed them; and only take written authorities so far as they agree with such impressions.

There are three great races inhabiting this region, about whom I speak from abundant personal experience—the Turks, the Greeks, the Slavs—and an older race still, the Albanians.

I.—The Turks.

Although it is no longer possible for the Turk to make

> "the loud fanatic boast
> To plant the Crescent o'er the Cross,"

yet he is still the most potent factor over that whole region, from the headof the Adriatic to the Golden Horn, and from Bucharest to Athens.

The mass of the people—Greek and Latin Christians, and Mussulmans—whether released from the Ottoman lordship or still under it, in habits and customs are very much what the Turks have made them. And allowing for the degrading influence that centuries of despotism must have exercised, this fact, that the Turk has been moulder as well as master, may be the chief reason why to a stranger the non-Ottoman peoples compare very unfavourably with the genuine Turk. The Turk no doubt is a despot, but he is a lord-and-master by nature, and a gentleman to boot. He may be "unspeakable," but that is usually because you cannot speak to him in a way he understands, or enter into his ideas and peculiar outlook upon the world of life. There are millions of Mussulmans who are not Turks (in Turkey), but Greeks, or Slavs, or Albanians; but there are no Turks (Ottomans) who are Christian! Do not think, however, that all Mussulmans (in Turkey) who are not Turks are Mussulmans by choice. No; they became so (or rather their ancestors did) rather than become slaves or dead men, 500 years ago, when the tide of Moslem conquest swept into Europe. Yet to this day, so far tolerant is the Turk, that side by side with mosque and minaret, even to the very precincts of the Yildiz Kiosk, and everywhere over the Balkans, stands Greek or Latin cross, on church, or chapel, or on embattled walls of monasteries in the mountain wilds.

A year or so ago, at the time when the Armenian troubles were at their height at Constantinople, and Macedonia was on the brink of revolt, and a Greek invasion over Mount Olympus was being darkly hinted at, I made my way into the heart of Novi Bazar, intending to get into Albania from the east. The average height of the land there is 4000 feet, descending to 2000 in the valleys and ascending to 7000 on mountain ridges. The roads, stony and precipitous, climb up and down the heights—for the valleys are too winding to serve as routes in any one direction. The people are very mixed, being Bosniacs, Albanese, and Rascians, and are very wild and lawless, while marauding bands are constantly roaming from one frontier to another—for here Servia, Macedonia, Albania, Montenegro, and Bosnia meet. At Plevlje (Turkish, *Tashlidja*), the Governor-General, Suleiman Pasha, implored me not to proceed, and farther inland at the romantic town of Prjepolje (in the rich valley of the river Lim as it carves its way through mountains from Lake Plava in Albania) something like coercion was employed to that end. The *Kaimakam* (governor) declared, "Sir, were you the Sultan's own son, and I to give you sixty zaptiehs to guard you, you would not be safe. It's death to go on. Pray, go back." Finally the awful storms and floods decided me to yield.

The Novi Bazar people are certainly more savage and less subdued than any other Slavonic tribe. They are thinner and slimmer in build, and more like Albanians in features than Slavs. Men, boys and dogs seem all to take every licence, with little thought of any restraining influence. They are marvellous horsemen—as they would need to be in such a country, where the path often rises 2000 feet in four miles—and how they do scamper and gambol on horseback in places where one would need both hands and feet to crawl up and down! Possibly guided by this equestrian instinct, a boy in one of their villages hit upon

as neat a definition of the bicycle as can be imagined. After gazing at it for a while in wonder, he muttered, "*Ah, boljі conj*—It 's a better horse!" Now, there 's sense in that. But how disgusted those active people were when they saw that it could not with equal ease as a horse climb a mountain-side!

Back in Plevlje. The Pasha was deeply grieved to hear my determination to go over Montenegro into Albania—the roughest route possible to choose in all the Balkans. But he procured for me all available information, provided me with soldiers to escort me to the frontier, and generally maintained the reputation he bears as one of the humanest of men and finest of gentlemen. There was something deeply pathetic in his attitude as he sat there in the *konak*, with the last rays of the sun illumining his severe yet open countenance, and told me how hard it was to govern well or wisely in a regime that was not leaving the world but that the world was leaving. The true oriental look of passive melancholy was on his face as he, the civil and military representative of a once mighty empire—vast still in its decadence, occupying its last seat of authority towards Europe, and marking many hundreds of miles of slow and painful retrogression—vindicated the honour and integrity of his race. The huge letters F. J. I. (Franz Josef I.), which the Austrian soldiers have built in with white stones on the sloping hillsides—indicating another empire whose difficulty in governing heterogeneous and mutually antipathetic races is as great as Turkey's—gleamed down as we conversed. Who knows how soon this may be the scene of bloody strife, involving all Europe in its issues? The Turkish gentlemen I meet all pronounce the Government (the wretched coterie of knaves and weaklings bred within the seraglio) corrupt and effeminate, but protest, "We are strong and healthy at heart, needing only reforms like other nations." The Turks have been a race of warriors and statesmen all along their path from the Altai (or Golden) Mountains in Central Asia, where for centuries they were, first shepherds, then armourers; and they have been prolific in great characters. What has changed them? It is not the *form* of government, for that is distinctly democratic. A donkey-boy, a shepherd, a peasant, even an enfranchised slave may become (as they have often) Vizier, Pasha, Cadi, or Bey. And yet the virtual rulers are neither representative nor typical. No, it is the *place* of government that ruins. The corrupt, enervate Byzantine civilization, which (in 1453) they displaced, has instilled its poisons into them as rulers. But the one grand point to be noted is this, that the rank and file of the Turkish people are now, as in the past, physically, morally, and socially sound. My own experience (in all parts of the empire) agrees with all the great authorities, viz., that the common Turk, peasant or soldier, is a man whom you are bound to respect for his many good, sound qualities, *e.g.* honesty, sobriety, modesty, bravery.

The Turkish soldiers may be unwisely incited at times to fanaticism, but there they are, as they stand—you meet them everywhere—grand material: patient, serious men, in the same patched and threadbare uniform of faded blue, with the red fez on their heads, poorly fed and worse clad, but fearless and faithful.

The mounted men (zaptiehs) that Suleiman Pasha sent me as an escort were no exception. So eager, buoyant, patient, kind, and simple-minded, and such favourites in the hamlets we passed, they made the best of companions.

Let me indicate how we journeyed together to the Tara and the Brda of Montenegro, up through the *goras* (rocky forests) and *planinas* (wooded mountains, usually crowned by a bare peak)—over grassy slopes, along dried stream-beds, through lanes of big stones, thick mud or deep sand, skirting forests, up through beautiful forest-land, among gigantic trees and dense undergrowth—not a sound breaking the eternal monotony of the forest hum-m-m, except when my youngest zaptieh broke forth into song "in praise of Vila." Who, you may ask, is she? Not to know Vila is not to know the Balkans. She is a spirit, nymph, or goddess, and knows no creed, for she is pagan and comes out of the elder world. As we ride over the deep velvety sward or beneath the tall spectral firs, or eat our bread at a well, or turn the crown of a hill, Vila may be about us, and it is well to be in her good graces. For she loves horses and rides the best; she sleeps at mid-day in the forest, her feet bathed by the rivulet; wild creatures are tame with her, streams and fountains sacred to her, and on the cloud-girt hill-tops she has her castle with its wondrous gates of scarlet, pearl, and gold. Strange, that a belief in the weird and supernatural should be the only point that unites the rival religions in Slavonic lands—their common inheritance of the primitive worship of Nature.

Suddenly we came to the brow of a mighty chasm, with the white domed head of Dormitor on the other side 3000 feet above, and the deep bed of the Tara 3000 to 4000 feet below us—a stupendous vision. Awe and admiration filled my mind before such glorious magnificence. In all my journeys I had seen nothing like this awful gorge in its abruptness and narrowness and depth and length—extending miles down from Albania, and continuing many more into Herzegovina, where the Tara joins the Drina—a regular cañon. A few hundred yards across lay the Montenegrin land around Dormitor, at the level of where we now stood in Novi Bazar, and that awful gulf between to be got over. This indeed is no sham of a frontier. As far as I could see there are no passes into it. The heights descend in two or three places by steep slopes alternating with almost sheer cliffs. Everywhere else, but especially towards the north, they fall, I may say, headlong, sheer down for 4000 to 2000 feet to the bed of the Tara, only interrupted occasionally by furrows or projections clothed with woods. The prevailing colour of those walls is brownish-red (granite), but most of the rocks I went over (both down, and up the Montenegrin side), *i.e.* in the most accessible places, are of a deep yellow (limestone).

Down we went by fearful zigzags around ledges and slantwise by almost precipitous walls, creeping through spiny underwoods, the zaptiehs leading their horses and I holding back my loaded machine, and getting scratched and pricked and tantalized by stones that *would* slip and bushes that would not yield a passage. At a *tchiflik* (farm) straight above the Tara some 1500 feet, we dined on *karmak* (curdled

milk), potatoes, and brown bread. Then down again by long, steep, grassy and harvested fields (where, for credit's sake, I cycled down in great sweeping curves), through woods and rocky paths again, high up above the river, till we came to a dark group of fallen rocks (granitic) beside the river. Here a raft worked by a rope crosses the Tara—a deep stream of beautiful blue water, thirty yards wide. A tall lank Montenegrin, wrapt in his brown *strouka* (plaid) and muffled up to the eyes, fondling a new rifle (Berdan pattern, presented by Russia), received me suspiciously on the other side and soon declared me "his prisoner." But within an hour he was *my* prisoner rather, for having yielded either to my arguments or to my "silver penny" and deserted his post as sentinel, he was panting and sweating under the weight of my machine up, thousands of feet, through the hanging woods and rocky sides of Pilitor.

II.—The Greeks.

Some would not consider them as Balkan people at all. But as this country presents similar natural phenomena, and as the stamp of Greek civil and religious life (either ancient or mediæval) is indelible on the whole peninsula, we cannot well consider them otherwise. Who are they? They are undoubtedly an inordinately mixed stock (as Latham terms them). If the ancient Greeks were Pelasgic mixed with Egyptian, Phœnician, and (ancient) Italian blood, what are the modern? All that the ancient Greeks were, but besides that, they are largely mixed with (later) Italians, Albanians, and Slavonians, the greatest of these mixtures being the Slavonic. I cannot go the length some go in saying that the modern Greeks are racially not Hellenes at all, but Slavs in the bulk. But this I will say, that seeing the best men physically are to be found in the mountainous interior, chiefly towards Epirus and Macedonia, these are probably of Slavonic or Albanian blood. Taking the test of pure Greek descent to be (as De Quincey holds) "an elegantly formed but somewhat undersized person, with a lively, animated, and intelligent physiognomy," I feel little hesitation in asserting that there is much of ancient Greece still left living and breathing in modern Greece. For these reasons: (1) With the exception of the εὐζώνοι (well-girt, mountaineers) the present Greeks are, in bulk and stature, smaller than the other men of the Balkans; (2) they are, on the whole, swarthy and lean, active and enthusiastic, as of old; (3) they are commercial, dwellers in cities, and traders along the seaboard and among the isles, as of old; (4) there is a light airy brightness, an ethereality of spirit characteristic of them, on the whole, all over Greece, that is very different from the heavier, slower nature of all the Slavs I know; (5) there is a predominance, I think noticeable, of topographical names in Greece to-day that are radically Hellenic over those that are Slavonic or even Slavonized.

But what is their present position? Right enough if, meantime, they only confine their ambitions to Greece proper. They have advanced much since their independence (1830). But they are developing too

quickly, exceeding their natural means. The fault of Greek character is (still, as of old) excessive individuality. A Greek will do anything to make a better bargain, and so often overreaches himself. Peasants' sons, *e.g.*, no longer content to till and reap the soil, must needs go to the cities (or monasteries) to become teachers, doctors, lawyers, and alas! professional politicians. There is no work for so many educated men in such a small country. Hence discontent, intrigue, debt, difficulty, and a false civilization. When in Greece twelve or thirteen years ago I saw this evil beginning, but in subsequent visits it glared me in the face. Everybody wants to be big, to have big buildings, mills, and machinery, and big methods, to carry on a very small business. It is hardly possible now to see (as it once was) a simply dressed man or woman in Athens or Piræus, Corinth or Patras—all affect the latest fashions. Athens is becoming worse than Paris in love of display. Luxuries far beyond people's means or station are in demand: useful articles, such as with industry would yield a return, can hardly be sold. They thus go on spending, and lightly say, "When it's all done we'll borrow, as the Government does." No wonder that everybody, from the Government down, has long been deep in debt. They have made too quick a start.

However, after all, the best Greeks are not in Greece, but out of it —in Turkey and the isles. It was this fact that precipitated the late Greek incursions into Upper Thessaly. All along the shores of Thrace (Black Sea and Sea of Marmora), and the borders of Macedonia, Greeks are settled in hundreds of thousands, more or less prosperous under Turkish rule, but still distinctly Greeks. They go by the name of Roum, *i.e.* Roman—but that only attests their genuine descent, for so the degenerate Byzantine Greeks called themselves, and to this day the home name for modern Greek is Romaic. Greece once ruled at Constantinople (in the Byzantine empire), and it is her modern dream to do so again. This is the chief object of that secret society known as the *Ethnike Hetairia*. But it cannot be, for Russia is against it, and Bulgaria too. The Bulgarians are now the mass of the people in Macedonia and even Thrace, and although for centuries they were amenable to Greece through the Greek Church, they have broken off, and, hating the Greek worse than the Turk, will henceforth resist instead of assisting any Greek advance northward by Macedonia.

Nevertheless, so subtle, quick, and bright is the Greek spirit still, and so potent is the influence it exercises over all those eastern isles and shores and cities, that I doubt not that modern Greece, with patience and self-control, will find itself some day restored to the better part of what was ancient Greece: and not all the wrongheadedness of petty politicians, nor the sufferings entailed by foolhardiness, will long retard that day.

III.—The Slavs.

Over the whole Balkan Peninsula (except Greece, Albania, Roumania) the Slavonic race predominates.

The great Bulgarian stock is now practically Slavonic through intermarriage, and speaks the Slavonic language—one of its two main Balkan

branches. By blood the Bulgarians are brothers to the Turk and the Magyar rather than to the Muscovite—being of Ugrian or Finnish origin. Slavs and yet not Slavs, Greek Church and yet bitterly opposed to Greek ecclesiastical and political pretensions, they are withal, by their dogged independence and patient industry, the most fit and likely successors of the Turk in Europe.

The other branch of the Slavonic tongue in the Balkans is the Serbo-Croat, and is spoken by true Slavs, viz. Servians, Croats, Bosnians, Herzegovinans, and Montenegrins. These take their names from the countries they occupy, but all call themselves Serbs—which is supposed to be the Latin equivalent of Slav, as if it meant *slave*, whereas the Slavs derive it from *slava*, glory. These all look back with proud regret to the ancient Serbian kingdom which their greatest czar, Stephen Dushan, extended to the Ægean and the Black Sea, and which their King Lazarus lost at the battle of Kossovo (1389) to the Turks; and they secretly cherish hopes that they will all be united again under a similar one.

(1) *The Montenegrins.*—Montenegro is not wide, as the crow flies, less than 100 miles any way across; but, as the track compels you to go, it is 200 to 300. It took me three days of hard toil, from early till late, to cross from NE. to SW. to Lake Scutari, and five days altogether to get to the coast. There are no roads except in the SW., around the capital, Cettinje, and these quite new. It is believed that by keeping all the communicating paths on the Austrian and Turkish frontiers in their wild condition there will be less fear of invasion. Indeed, it would be a bold army that would attack Montenegro anywhere except from the south; yet, all round Montenegro, on north and west, Austria has thousands of her finest troops waiting emergencies—enormous military encampments which have surprised me as I came across them in deep mountain hollows, or on bare upland plains. When I had scaled the stupendous walls that rise almost sheer up from the Tara river, and had come out on to the shoulder of Pilitor (6000 to 7000 feet), the people there who gave me shelter could not understand how I had ever got up that terrible *granitza* (frontier) at Tara. "Ah," they said, "the Turks can never cross Tara: Tara is too much for them."

The average height of the land here is 6000 feet, over which Dormitor towers (9000 feet), one mighty (dolomitic) mass, rising like a dome. This region, to be habitable, is the most inaccessible part of Europe. Such a thing as a decent track does not exist for fifty miles at least every way from the base of Dormitor. A long series of ridges and corresponding depressions—running mostly north-west and south-east—make up Montenegro, with here and there a *zupa* (or sunny land) in the valleys, and a few wide bleak tablelands. Right over these ridges, up and down and up again, every four or five miles, rising and falling from 1000 to 3000 feet each time, is the *only* way to the coast. A sketch of a typical Montenegrin track may be of interest. The scenery as we ascended was magnificent, as valley after valley opened up with their silver streams, and range beyond range, invisible before, now loomed on the vision. But such a track! Stones of all sizes, from mere chips to

cyclopean blocks, with keen jagged edges, presenting themselves at all angles to the traveller, and big long sloping terraces, now up and now down, tier above or below tier—such made up the road line (over one ridge) for five or six miles. The sun like a furnace; not a drop of water; no shade on right or left, only low scraggy spiny bushes; no help and no hope (but to go on), for everywhere stretched the same awful wilderness of rocky pits. At last, when wellnigh spent and gazing hopelessly down the last few hundred feet of terrace-wall, a young man in pity helped me to clamber down on to the shore of the river Crachanitza, where there ran a beaten path into the town of Niksitch.

The wild grandeur of those ridges, as seen in the ascent, is indescribable. The vegetation may be sparse, but the forms and colours of the rocks (brown porphyry and grey limestone), the configuration of the land, bluff precipices and hanging woods and fearful hollows, are extraordinary. The path, one mass of stones, is so steep, that if there were no stones the feet alone could not raise the traveller up it. Streams in deep or even underground beds pour down on every side, and sweet it was to hear their music echoing through the woods (of dwarf beech and oak) and against the cliffs. Through woods where huge weazels and squirrels and big black hares and strange bright-plumaged birds (kestrels, rollers, and the like) darted about. Across a bit of plain, up another wooded mountain of awful stillness, round and round bare stony ridges, with here and there a mound of gritty sand. Sometimes we came across a shepherd with his flock, piping away on his *gusla*, sometimes a caravan of riders (men and women), bristling with swords and rifles, sometimes I would rest in a grove beside a hut, while the good folks would gather around and tend me. I noticed that towards the east, on the lee side of these ridges, the vegetation is profuse enough, but everywhere else—plains, ridges, wherever exposed to the sea winds—all is barest sterility, sometimes square miles in one vast field of nothing but stones, stones, and scraggy bushes.

Such being the nature of the country, there is no wonder that the old semi-barbarous customs of the East are observed in all their quaint or wild purity exactly as a thousand years ago. The patriarchal system prevails: everything is referred to one individual, usually the *capetan* or *serdar* (colonel), who is at once sent for on one's arrival in a village. Women, while having every freedom, are regarded as inferior creatures, or, as their proverb has it, "Our women are our mules," and it is amusing to see with what quiet superiority the men look on while the women carry loads, grind corn, cut wood, and do heavy labour. It would be untrue to say the women are slaves—quite the reverse; I never saw such fearless, self-possessed, yet quietly contented women anywhere else. The men are drovers, shepherds, and guardians of the general security; the rest, including much of the field work, they leave to the women. Both men and women are splendid creatures physically as a rule, and mentally are, if simple-minded, far from dull—indeed, rather above the average humanity. But what strikes me as indicating the inferior status of the women is that, while the men are often singing and conducting themselves with rude, boisterous mirth, the women are

pensive and rather languid in expression, and seldom sing except in lamentation.

There is a rude brusqueness, joined to a certain unpracticality and volatility, about all the Slavs (not very noticeable among the Bulgarians), which the Black Mountaineers show most. They are not adapted for town life, but for war and the chase. What fine handsome figures and faces these Montenegrins have! How hospitable they are, but how patriotic! The fondness with which they roll out the *r* in *Tchernagora* (the name they call their country) is amusing. They are all soldiers (from the age of eighteen to fifty), all sport their rifles, and though our proverb of being "born with a silver spoon in the mouth" does not apply to them, they boast as an offset to their poverty, "Our babies are born with a gun in their hand."

Scene showing family life in the very heart of Montenegro, at a place called Bukovik, 3500 feet above the sea:—At nightfall I put up at a low-roofed shed, with a door and a hole for a window. We gathered round the central fire on the mud floor, over which a great pot (containing potatoes and milk-curds) was hanging by links from the roof. Walls and rafters and roof were painted a deep glossy black by the smoke of many years, and the blaze of the fire glittered and danced over them most beautifully. The *gospodin* (host) sat by my side in his grey tunic and black cap with red top (the national costume). The *gospoya* (hostess), with braided black hair and dark Eastern eyes, sat opposite, serving out coffee, cup after cup, from the big kettle half buried among the hot, glowing ashes. There were, besides, the three boys, very demure; little Milan, ill and restive; a big girl in faded black; and last, but not least (a grand woman in build) the sister-in-law, asking whether she or the wife was the prettier. Retired to rest, we were nine in one close room, the *gospodin* and I on a huge family-bed, fit to hold a regiment (which it did!), and all the rest on clothes spread on straw on the floor in various positions. A feeble lamp, sputtering on the wall, was left burning—an invariable Slavonic practice. Long before the last soft mutterings on the lowly couches died away I was aware that my elevated one at least was alive with fleas, and, more hateful still, with the *yellow* cannibals. Moreover, the coming on of winter had apparently sent all the flies of the countryside indoors, for the whole place buzzed and swarmed with them. Far in the night there was a rustling outside and a patter of feet, and the man arose, muttering "*vutché*" (wolf), took down a long pistol from the joists, went out and fired it off, then crept back shivering into bed. And to think that such must be the daily life of these people! Wretched and hateful it must seem to us, but it is not so entirely to them. Those who survive the rigours of life here, and are so strong that neither bad sanitation nor bad ventilation, nor extremes of heat and cold, nor dirt and vermin can injure them much, seem really as happy as people are elsewhere.

The southern side of Montenegro is the richest and most interesting. This district, all round the Lake of Scutari and far north and east among the mountains, was the old principality of Zeta, and was held by the

Serbs for 700 years. The noblest Serbian names belong to this district, and the best Serbs still seem to be nurtured here. Podgoritza is its chief town (but comparatively modern, meaning "hill-foot"), but about two and a half miles south there are ruins (close to the frontier) of a much older town, which is probably that "Ribnitza in Zeta" where the old chroniclers say was born "Némania, who became Grand Zupan (or governor) of the Serbs from the Danube to Scutari," and who founded the Nemanijitch dynasty, whose greatest member was Stefan Dushan. The northern borders of the lake are associated with the valiant prince, Ivan Tshernoyevitch (last of Zeta and first of Montenegro), whose "white castle of Zabliak" still frowns down from the top of its conical hill upon the waters, and whose secret tomb lies somewhere among the beetling crags that overlook on the west the incomparable Gulf of Cattaro and on the east a world of peaks and ridges stretching away to Dormitor and Kom; "for there he sleeps with his horses this half millennium, to awake on the day that sees the last Turk quit Europe." The lake's southern borders, again, witnessed many of those valorous deeds which made his kinsman, Geo. Castriote or Scanderbeg, for a time (end of the fourteenth century) the hope of dismayed Christendom. But a greater name than Serb is also here, viz. Roman; and a greater czar than even Stefan Dushan came (probably) from here, viz. Diocletian, the Cæsar of Rome. About three miles north-west of Podgoritza there is a village on the banks of the Zeta called *Dukla*, and there lie the extensive ruins of ancient *Dioclea*, from which they say that emperor, being a mere freedman, took his name, turning the barbarous *Docla* into something with a savour of divinity in it (the *Dio*), so *Diocles* (elect of God), Diocletianus. Whether the ruins are as old as his time (the end of the third century) I do not know, but from the style of inscriptions on slabs, gates, sarcophagi, and other monuments, and from the shape of the columns and mosaic floors still standing, I should say they were not far from it. They cover about twenty acres, but doubtless much more is hidden. It was as ghostly an experience as one could have to wander there in the moonlight among those ditches and ramparts, once ancient streets and walls, and by the light of vestas read the fragmentary sentences that tell of the faith or valour of a millennium and a half ago. A peasant, living in a hut amid the ruins, took me to a spot where the whole mosaic flooring, from porch to chancel, of a considerable Christian church is seen almost perfect.

(2) *The Bosnians and Herzegovinans.*—These, although Turkish subjects still and mostly Mussulmans, are under Austrian administration. Theirs is a magnificent country, a world of mountains, hillsides clothed with endless forests, valleys filled with fruits and flowers and corn and wine, and an atmosphere of romance and mystery pervading all. Brave, stalwart, healthy fellows they are, who, though often beaten, were never cowed, the last to admit the Turk, and, as lately as 1879, resolute in their resistance to Austria. Tall, muscular, hardy, simple in habits, given to meditation, serious, undemonstrative, there is nothing of the abject about them. An Austrian officer, at whose guardhouse I slept when belated one night, summed them up thus to me: "From every point

of view they are better than we. We are here to keep them in order, but, bless you, they never hurt anything."

One thing distinguishes all the Bosnian lands (including, though in less degree, Montenegro and Novi Bazar) from the rest of the world, and that is, the presence of those strange Bogomilian stones—sepulchral, yet undoubtedly more than sepulchral in significance. You find them (150,000 in all) massive, plain, or carved and sculptured blocks, singly or in groups, in the heart of dense forests, on the lofty brow of mountains, on the centre of bleak upland moors, by the banks of lonely rivers, mysterious, revered of old. The Bogomile religion (the last adherents of which became Mussulmans, I am told, a few years ago in Kojnitza on the Narenta) was neither Latin nor Greek, but some peculiar grafting of Nature-worship on to Christianity, observing few rites, but following Jesus and loving God in simplicity. Whatever else is in the word *Bog* (God) is in it—either *Bog-u-mil*, loved of God, or *Bog* and *gomile*, an ancient tomb; for with these Serbian peoples it is *Bog* this or *Bogu* that all the day long.

Some say there is a marked difference between the Bosnians and Herzegovinans. If there is, it is due merely to the more mountainous, more rugged, and poorer land the latter inhabit. Perhaps, on the whole, the Herzegovinans are fairer in complexion, with higher cheek-bones, taller, and lankier. Certainly they are franker, and bolder, and brighter —boys and men, and even the dogs, seem to take life more enthusiastically, are readier at resisting intrusions, and also at welcoming a stranger, in Herzegovina than in Bosnia; and I may say, in passing, that this distinction applies also to the Dalmatians, who are not, as some who visit them only on the maritime border allege, more Italian than Slavonic, but essentially the same in character, habit, and appearance as their neighbours behind them. The same degree of difference that you see between a Herzegovinan and a Bosnian you see between a Bosnian and a Croat in Turkey, and again between a Turkish Croat and a Croat in Austria—the latter being the most subdued of all, the best fed, the best housed, but *not* the best man—*he* is at the other end.

The general characteristics of *all* Illyrian lands are these:—Alternating grimness and beauty everywhere, on land and people—on the landscape, long tracts of hill country utterly naked, contrasting with glorious long, deep belts of forest on the upper mountains (*goras* and *planinas*) and with the cultivated plains, or *poljes*, beneath; on the vegetation, fields of rock, producing only gaudy thistles and scraggy bushes, over against smiling gardens and waysides profuse in flowers and fruits; on the people, handsome, frank, and bold on the whole, in broad and strange contrast to many among them of a gaunt, suspicious, disagreeable type.

Scene in the heart of Bosnia:—The mountains, hanging with dark forests, retreat from both sides of the pass (through which the river Vrbas rushes noisily) up to 4000 to 6000 feet, but never lose their awful sense of overheadness. Turn after turn, always the same wild weird look, always the same richness of colour and variety of form, and that "boskiness" which gives Bosnia its peculiar character.

Occasionally one hears, but seldom sees, the daring shepherd lads and lasses calling to each other in their wild musical Slavski far up among the bushy beetling crags. At Krupa, where the huge heights retreat as in a ring, a little church is seen on the hill over the road, and on a lofty peak above that are an old mediæval fortress and tower, the ruins of which seem to cover half the ridge. The people here are *rayahs* (Christian peasants) and seem happy. The men wear a black turban, with long hair hanging over neck and forehead, and the women many ornaments, such as chains of coins or spangles and embroideries of wool and pearls. On a harvested field a score of girls were dancing hand in hand in a ring, while the men were looking on, some of them singing.

A mountain scene in Herzegovina :—Beyond the Ivan Pass a marvellous scenes bursts into view. The yellow mountain masses close in, in wildly romantic shapes, cleft, burst, terraced, turreted, domed, to form the eastern side of a peerless natural amphitheatre. Right down as if in the bowels of the earth a dark cavern seemed to yawn, of Titanic dimensions though miles away, and filled with glorious purple as gladdening to the eye as dark sparkling wine to the palate. It was the deep mountain-basin in which Kojnitza lies. Sheer overhead beyond that the enormous Prenj Mountains (6500 feet) rise, blocking out the whole south-west, wall upon wall, dome upon dome, turret upon turret, field upon field, peak upon peak, as if it were the end of the world. And up far in the heavens among the white fleecy clouds—and yet as if almost on a level with my eyes, across the mouth of the purple abyss—there was a fearful sight: a gauzy silvery shimmer lay along the loftiest tops, like heaven's steep ascent just below the gate, and broad shining beds of snow were lying so still and solemn that Death and Life seemed to have wedded there and realized Eternity.

Scene in the heart of Herzegovina :—In the Morinje, an almost trackless region, average height over 4000 feet, with higher mountains still all around it in the distance, "unique in its melancholy monotony," no bush or shrub or house for miles often, nothing but long grass, yellow rock, and here and there a yawning lime-pit. At a dismal spot, so parched and blackened that it looks like a scene visualized out of Dante's Purgatorio, a sluggish brackish stream coils round a rocky basin, on the edge of which stands a miserable grimy *khan*. On entering I heard voices speaking in Slavski, but could see nothing for the dense smoke proceeding from a wood and turf fire and only finding imperfect vent by a hole in the roof. What was my surprise when, on passing into an inner apartment, I beheld in that more than semi-darkness a Greek priest in his black clothes and flat-crowned hat engaged in a vigorous sham fight with a fine gloriously vested Herzegoviner! Theirs, however, was greater than mine. Who are you? Whence? Whither? How came you? By horse?—No. By waggon?—No. Then how?—Go and see outside. And they could not credit my repeated assurance that I had in very truth come up there "with such a delicate creature."

(3) *The Croats* :—In Italy and Austria to be a Croat means popularly to be a boor or a buffoon. They are sturdy wights for all that, and though perhaps the most subdued of all the Slavs, they have their

qualities—one being fidelity, another good-nature. When I think of Croatians, somehow I see half-naked men walking along muddy lanes in their dirty white robes, touching their hats deferentially as they pass, and women the most sparsely dressed in Europe, perfectly frank but modest and quiet. When I think of Croatia I see, now rich rolling pastoral country, where the road passes through villages two or three miles long, the houses with their gardens and orchards lining the road, each stockaded off from every other, and where all the roads and glades are alive with living creatures—horses, pigs, geese, naked boys and all but naked older people; now long marshy plains dotted with forests of stunted willows, poplars and oaks, with here and there beneath them the shimmer of water, and naked children floundering about in it like schools of porpoises; now a whole village built on piles (*e.g.* Gradiska on the Save), with people rowing in boats instead of walking along streets; now, at midday, among luxuriant creepers of gourds and melons, I draw icy water from a deep well by a long weighted pole balanced on a standard; now, at twilight, I sit on grassy ditch or cosy corner in the *gostiona* (inn) and hear the love-sick swain pour forth his ardent soul in praise of "somebody" among "the green meadows by the banks of the blue Danube."

(4) *The Servians*—in their kingdom on the Danube:—There is little doubt that, if not the purest, these are the oldest of properly Slavonic peoples. They ought by this time to have learned the value of political liberty, for their vicissitudes have been most numerous. They come from the classical Mœsians and Triballians. From the days of Philip and Alexander, and Augustus in his Pannonian campaign, they have been overrun, but have retained their distinctive character—Slavonic beyond a doubt, not so subdued as the Croats, not so fierce as the Bosnians. Their country (ancient Mœsia) consists of undulating hills, great forests, and several long plains, bounded by the Danube on the north, and by the Bulgarian, Illyrian, and Macedonian mountains on the other sides. They are the most ambitious of all the Slavs, and the most restless. They are rapidly becoming Europeanized, but so far, I fear, it is with them a case of "new wine in old bottles"—the ferment is too strong for them. They deem themselves the rightful heirs of the glory of the ancient Serbian kingdom and are seeking to actualize it again. I have met their emissaries—vivacious, enthusiastic men, fairly educated—working for this end in all those Western Balkan provinces: and their hope seems to be that, if ever Austria's power is lessened, they will be able to unite under the Servian crown Bosnia, Herzegovina, Croatia, Dalmatia, and even Montenegro and Novi Bazar, and so form a new grand Servian nation in Europe. Well, we shall see.

IV.—The Albanians.

These are neither Greek nor Slav nor Turkish in blood or appearance. Lord Strangford is probably the only authority who questions their distinctiveness and antiquity. From all that I have seen of them I hold them distinct. Neither Latham nor Max Müller seems to be able

to decide what they are—or rather what the ancient Illyrians were—apparently hesitating between a Celtic and a Sarmatian (Slavonian) origin: but both agree that they are of the Aryan family. The name Albania seems ancient, although it may have been only in later (Roman imperial) times applied to the country on the Adriatic. The people do not call themselves Albanians but *Skipetar* (*i.e.* mountaineer, as their country is *Skiperi*, land of rocks): and in agreement with this Latham finds the Celtic root *alp* (mountain) in Albania, as in Albyn and Albion. Max Müller (following Boré) attempts to find the root *ar* (of the element *Arya*) in the Caucasian Albania (modern Daghestan); and strangely enough the Turkish term for Albanians, viz. *Arnauts*, corrupted from the Byzantine *Arvanitæ*, favours such a view. At any rate their language is peculiarly distinctive, is classified by Max Müller as Illyric, and must be a relic of the ancient Illyrian speech once prevalent all along the eastern shores of the Adriatic. Many of the scenes and customs of daily life one witnesses in Albania cannot have changed for 3000 years or more, *e.g.* their guest-friendship, their blood-feuds, their tribal system, their dress. Where but in China or Thibet will you see anything so unique as the Albanian conventional head—shaved bare to the crown, with a long fringe round the back, depending often like lovelocks?

Their country is the most inaccessible, the most unknown, in Europe, and perhaps the most richly beautiful. The lofty undulating ranges (6000 to 8000 feet) of Procleta and Kroia behind the Lake of Scutari and the Gulfs of Drino and Durazzo harbour the most untamed tribes perhaps in the world, *e.g.* the Mirdites. As I saw these, they are rather squat and square, coarse-featured, and plainly dressed in dirty grey capotes and skull-caps or hoods. The Northern Albanians are generally called Gheghes, are dark in skin and eyes, being mixed with Slavonic blood. The Southern Albanians are called Toskhes, are fair with blue eyes, being mixed with Greek blood. They loathe each other—and this is so far proof of their different origin, for racial difference is usually at the root of these hatreds.

It is in Scutari that you see the best specimens of the *Skipetar* in all his characteristic individuality—a big lanky man with small features and a distinguished air. Some wear a red jacket, red fez with long blue tassels depending, and pure white fustinellas; others wear red from head to foot, with close-fitting trousers; others are clad in a coarse stuff of light brown embroidered with black.

Here and there, on the rich narrow plains, we come upon true Albanese encampments—reminding one of Homeric times—whole families, men, women, children, with their pigs and cattle, sheltering under great forest trees, lying on rugs, cooking food, or tending their beasts with the help of huge ferocious dogs. Their dark faces, their long black hair, their rough tattered cloaks, their fearful pistols and knives, make a most savage, forbidding picture. These fellows, never disarmed, care nothing for law and authority. If threatened, they simply disappear among their mountains. Strange to say, the only bond they seem to respect is the old "guest friendship" of which we read so much in Herodotus and Xenophon. My experience of dreaded Albania (after two visits) is that

one has more to fear from the officials than from the natives—brigands and cut-throats though they be. For unless you have "made an enemy," if you are passed on from place to place "under friendship's bond," you are safe. If you eat bread in a village, then the name of your host will protect you on to the next—your wrongs becoming his wrongs, which he will do his best to avenge. It is not the awful roads nor the swollen streams nor the mountain defiles, but the *inquisitiveness* of the people and the "*cussedness*" of the Turkish authorities that are fatal to the traveller's progress.

Let me indicate typical Albanian scenery:—Villages with red-tiled roofs on the hillsides, flocks of very fleecy goats and sheep, white-eyed buffaloes wallowing in the mud, herds of grey and black and brown cattle on the river-islands, great birds making the air vocal and lively, long lines of poplars and willows and other trees intersecting as they fringe fields and streams, immense piles of gathered fruits or nuts in yards or barns, show the richness of the land. The mountains rise one beyond another, all wooded, with the beautiful red earth showing in clefts and patches, and here and there a white house gleaming amid the green woods. Sometimes the roadsides are flanked by streams with tall trees shading them, or blocked with enormous growths of gigantic elders and mulberries, and tall fern-like shrubs interweaving like filigree, and brambles bearing great luscious berries in millions. Sometimes the track is through lonely bits of dense forest, sometimes high up on cliff-sides among broken rocks, but oftener along sweet flowery but muddy or sandy lanes. Sometimes the landscape is enhanced by the sudden jutting up of an old castle, not without historic interest, 1000 feet or more, at the turn of a valley or the bend of a river. Sometimes under the spur of a mountain the ground is very marshy, the vegetation sub-tropical and dense, great white-stemmed abeles grow out of masses of gay flowering underwoods, while hoopoes, kestrels, rollers and vultures flit and screech all around. If the route is near the shore, sometimes you have to trudge for miles over immense sandhills which the tempestuous Adriatic has piled up twenty to fifty feet above high-water mark.

Here is a sketch of one day's journey—from Durazzo to Kavaya:—For five or six miles we rode along a beautiful strand, the waves on one side, deep sand on the other. Behind us lay the jagged and picturesque promontory of Durazzo, like an island in the sea—separated from the mainland by gleaming lines of salt-pans, among which here and there the white refuse heaps stood out, so many remembrancers of Lot's wife. Before us a long line of tremulous mirage, trees and water and hills, far above the actual land, from the real mountains to Cape Meschino at the other end of the bay. Striking inland over the long meadow-plains of Kavaya, which stretch from the shore to distant ethereal "vast Tomorhit," and are covered with endless flocks and herds, stopping occasionally at some humble farmhouse to drink coffee and munch a roasted *cucuritz* (maize) cob, through waving blue-green groves of olives, we reached Kavaya. It seemed asleep in the heat of the day, but in an instant it was awake; and the streets filled with young and old, bare shaven heads or bulging turbans, in marvellous costumes of red, white, black and blue, all speechless at first with astonishment.

No wonder the old imperialists loved this Albanian coast. Nature is so vast and yet so sweet here. The blue sea, the fiery skies, the deep gorgeous tints of the soil, the rich verdure, the rugged mountain barriers, the distant luminous grey peaks and masses, the roll of the waves breaking far and near upon the shore, the play of the lightnings at nightfall, impose upon the mind imperiously.

A JOURNEY FROM KIRIN, MANCHURIA, OVERLAND TO MOSCOW.

By James A. Greig, F.R.C.S. (Edin.).

(*Read before the Society in Edinburgh, on March 10th.*)

After spending a number of years in Manchuria the prospect of paying a visit once more to my native land was very agreeable, and long before the time for starting I found myself considering the various routes to Europe.

Having travelled both *viâ* America and *viâ* Ceylon, it occurred to me to go through Siberia. This route had the advantage of being entirely new to me, and also it had a little spice of enterprise and adventure. It seemed specially interesting owing to the great Trans-Siberian Railway, now being constructed, and in view of the trend of recent events towards Russia gaining political ascendency in Manchuria and Corea. So I finally decided to see something of the Czar's dominions.

After consulting friends who knew something of travelling in Siberia, and reading what literature I could get on the subject, I planned my route. Mr. Alexander Hosie, Her Majesty's Consul at Newchwang, sent me an itinerary of the Siberian overland route made by a gentleman who travelled along it some years ago; Mr. Hans C. Schiern, of the Chinese Imperial Telegraph Service, gave me advice about the routes from Kirin to Siberia; and Mr. Agapeief, a Russian engineer, who was under my treatment in Kirin Hospital, furnished me with a number of Russian phrases. To these gentlemen I wish to offer my hearty thanks for their valuable help.

I chose the route *viâ* Vladivostock, Blagoveshchensk, Stretensk, Irkutsk, and Krasnoiarsk to Moscow.

A good many preparations had to be made before starting. Having no interpreter, I had to devote some time daily to acquiring enough colloquial Russian to make myself understood to the officials, drosky drivers, porters, etc., with whom I might have to do. Money had also to be arranged for, and a very strong provision-box made, divided into compartments. I sent my national passport to the Russian minister at Peking, and applied for permission to travel in Siberia and Russia. The minister had to telegraph to St. Petersburg, and so many delays occurred that I did not receive my Russian passport till I reached Vladivostock.

At last the 7th of June arrived, the day I was to leave Kirin. My colleagues, the Revs. Alexander Crawford, J. Omelvena, and Dr. Living-

stone Learmonth, and a large number of Chinese friends, gathered to see me off. The Tartar General of Kirin sent me a mounted escort of ten soldiers, the road I was going by being considered dangerous from mountain brigands. My baggage, which of course was as little as possible, was put into a Chinese cart drawn by three mules, and driven by a crusty old Chinese carter. My Chinese servant agreed to come with me as far as the Russian frontier, and then to return on my horse to Kirin.

After engaging in divine worship, we started. All my friends accompanied me as far as the ferry on the Songari, about three miles east of the city. Here I bade most of them farewell, but Mr. Crawford and our Chinese chapel-keeper, Li, insisted on going some miles farther. Shortly after noon these friends turned homeward also, and I felt I was really off on my long lonely journey across two continents.

Presently we met a party of Chinese soldiers, with three captured robbers, whom they were taking in chains to Kirin for trial. I asked one of my escort about the prisoners, and he significantly stroked his upper lip as if shaving, and said *hu tzŭ*—that is, "whiskers." This is the name given to brigands in Kirin, and expresses the belief that the more you decapitate the more they multiply. It is frequent in the city of Kirin to behead thirty or forty at once on the public execution ground, outside the west gate, and I have seen between twenty and thirty heads hanging in wooden cages on trees shortly after the execution, and the bodies lying naked in a pit, called the "myriad men pit," near by. It is said the present governor beheads over five hundred criminals every year, and yet brigandage continues a scourge of the province.

Our road soon became very beautiful. We wended our way by bridle-paths through shady glens and over grassy hills. I preferred the saddle of my pony to the jolting of the springless cart. In the saddle it was delightful. The pure upland air, the warbling of birds and cooing of wood pigeons, hawthorn bursting into blossom, and the rushing of mountain torrents over their rocky beds, soon dispelled the sadness of parting.

In the afternoon our progress was suddenly arrested by a swollen river. The soldiers counselled waiting on the banks till the water went down a bit. Chinese soldiers are a lazy pack. "No," I said, "we have lots of rivers to cross and we cannot afford to wait on the weather." It was very reluctantly the carter and servant unpacked the cart and transferred the goods to a small canoe, which had to make several trips to and fro, and was nearly swamped by the force of the current. But, knowing the Eastern character, I felt that, unless I asserted my authority at the outset, my journey to the Russian frontier might be indefinitely prolonged. The result was satisfactory. Within an hour we were all safely on the other bank, and at nightfall I found that we had covered thirty miles in spite of delays and rough travelling.

When I saw the inn at which we were to stay the night, I resolved to sleep in my cart. The best inns in Manchuria are not famous for comfort. As a rule, they have brick beds, paper windows, plenty of smoke and numerous little animals; but the inns on this unfrequented road take the palm for discomfort. After supper I spread my mattress on the cart, rigged up my mosquito net, put some oilcloth over the

blankets to protect me from the dew, drew a big cap over my ears, and spent a very good night, avoiding the bad air, the noise, and the creeping things of the inn.

Next morning we were on the road before five o'clock, and soon had to ford a pretty deep river. I followed the lead of one of the soldiers. Although the water rose above the horses' girths, the high wooden Chinese saddle of my guide kept him dry, but in spite of my efforts to keep my legs up my top-boots filled with water, much to the amusement of my escort. My provisions and box of clothing on the cart got soaked, and at our midday halt we had to spread out the wet things to dry.

The mountains now became higher and more picturesque. One in particular, called the Trumpet Mountain, with many sharp peaks wooded to the top, attracted my attention. It seemed to me 2000 or 2500 feet high. From a point near the summit smoke was curling up to heaven. "Probably an ambush of banditti," I said to my carter. He nodded assent, and pointed to the revolver at my waist, as much as to say, "I hope you are ready."

Day after day was spent in climbing and descending long mountain passes, the roads often covered with huge boulders and fallen timber. We traversed dense forests of oak, beech, birch, poplar, and pine, and saw numbers of walnut, plane, and hawthorn trees, and also wild rose bushes, raspberry plants, white jessamine, and wild vines. I found some bunches of lily of the valley, and blue irises, red lilies, and large peonies were numerous.

One evening as I was walking along through this lonely Manchurian jungle, a party of travellers, going in the opposite direction, appeared. They proved to be two Russian officers, with an escort of Chinese soldiers, on their way to Kirin, searching for coal in connection with the projected railway across Manchuria. The coal used in the Kirin arsenal is brought from a place not far from the road we were on, so, I think, they would soon find what they were looking for.

This part of Manchuria is very sparsely populated. Now and then we came on a picket-station, where our guard was changed, and occasionally saw small farms, with a clearing of cultivated land around; but often for miles there were no signs of human habitation. Truly here we were in the backwoods of China. What a boon it would be if China had a good energetic Government, which would relieve the congested districts of China proper by encouraging and helping emigration to fine fertile valleys such as these!

In the early mornings, before the mists had risen, I was greatly tormented by swarms of small midges that penetrated the fine mosquito netting I had over my head, and inflicted torture on my face and neck. I tried washing with a solution of alum, which some travellers recommend, and also carbolic lotion, but without much benefit. After the sun rose the midges disappeared, and large striped hornets took their place. Their bites, however, did not cause such itching, but were very severe on our horses and mules, the white mules often looking quite mottled with the numerous points from which blood was oozing. But, notwithstanding these and other discomforts, this part of my journey

was most enjoyable, especially the early morning rides through dewy glades and over rugged mountain fastnesses. The long days in the open air, the hill climbing, and the fine Manchurian June weather, gave me a splendid appetite and made my sleep at night sound and refreshing. I thought of the thousands of city clerks to whom such a holiday would be like a breath of heaven.

On the seventh day from Kirin I came down upon some Corean huts, and knew I must be nearing the Corean frontier. The Corean men, with their loose white cotton trousers tied at the foot like pillow cases, and the Corean women, with their long white skirts and the waist just under their arms, greatly interested my Chinese servant. "So these are the people of the small nation," he said; "how strange they look!" and congratulated himself on belonging to the great nation (China). The Chinese look down upon the Coreans with supreme contempt.

At a pretty large village called Tung Fu Ssu, where we spent a night, the innkeeper claimed me as an old friend. I did not remember him; but he had been in Kirin, and knew a good deal about our Medical Mission there. He related some stories he had heard about some of our surgical operations, and amused me by introducing me as "the high foreign official in charge of the medicine manufactory of Kirin."

The valley of the Tumen River, which is for some distance the boundary of Corea and Manchuria, showed evidences of the great floods of the previous year, which had wrecked several villages and caused much loss of life. The fields for miles were covered with silt, and the poor people were looking forward with apprehension to scanty crops and famine next year.

For more than thirty miles before reaching the Corean frontier we found the trees and shrubs covering the hills nearly destitute of leaves, owing to a devastating scourge of caterpillars. The natives told me that last year the foliage was quite intact.

At noon on the 17th June, just ten days from Kirin, we reached the Chinese garrison town of Khunchun, and this is considered a very quick journey. The distance is about 300 miles, and the road rough, hilly, and here and there broken by rivers with neither bridges nor ferries, and only very unreliable fording-places. We were fortunate in our weather. Had heavy rain fallen, we might have been greatly delayed.

Khunchun is a town of about 10,000 inhabitants, 3000 of these being soldiers, and is the residence of a military general. It is only about ten miles from the Russian frontier.

Here, next morning, I changed my Chinese cart for a four-wheeled Russian *telega*, resembling a small goods lorry. I sent my Chinese servant back to Kirin on my pony, giving him permission to wait a few days before starting, as the pony sorely needed rest. I said good-bye to my escort, which, in true Chinese fashion, had gradually dwindled down to two ragamuffin foot-soldiers.

Seated on the top of my bedding and baggage, I drove through the town, and over the plain eastwards to the Russian outpost of Kalu. About ten o'clock we saw the first Russian houses standing on rising ground in front of us. Some were of red brick, and others of pine logs,

with corrugated iron roofs and small square double glass windows. It was a great change from the brown mud and grey brick buildings of Manchuria. When we drove up, a Cossack soldier in white tunic and cap came forward and demanded his pass from the Chinese driver, which he promptly produced. Turning to me, he asked for my passport, and I tried to explain to him that it had been forwarded from Peking direct to Vladivostock. He did not seem satisfied with the explanation, but allowed us to go on a few paces to a small Chinese store, where we were to take our dinner. He came back afterwards, and though he seemed to doubt my story, translated into Russian by a Corean, he finally allowed me to pass.

That afternoon about three o'clock we came in sight of the blue waters of Possieta Bay, and by seven in the evening reached Novo-Kievsk on the north shore of the harbour. After spending my last night at a Chinese inn, we went on next day to the little town of Possieta to wait for a steamer going to Vladivostock. I had two days to wait, but there was plenty to interest me. I had come into a new world. I watched the Russian troops drilling. What a contrast to the uncouth, unkempt, undisciplined, petticoated Chinese army! Here, on the other hand, the military are in a high state of efficiency. I got to know two officers a little, and, from what I saw of them, I formed the opinion that a small Russian army led by such men could take and hold the whole of Manchuria without much difficulty.

I put up at the post station, and first mended my clothes, which had got worn a bit by the mountain journey. That done, I went out and studied the lazy habits of the Corean fishermen, had a delightful bathe in the clear, cold, buoyant waters of the bay, and then hired a fishing boat and enjoyed myself sailing about the land-locked harbour.

On Tuesday the 22nd of June I got a small coasting steamer called the *Norik*, and a six hours' voyage brought me to Vladivostock, the Sebastopol of Siberia. It has a commanding situation on a number of hills, at the head of a magnificent harbour, the entrances to which are said to be strongly fortified. The town has a very new look. I suppose it is only a few decades old. The houses are mostly of red brick and of wood. There are several conspicuous public buildings: the Greek Church, with its pear-shaped domes, the Admiralty House, Museum, Library, Post-Office, and the large merchant block of Messrs. Kunst and Albers. The military element predominates. You meet officers and Government servants at every turn. The population is about 40,000, made up of 26,000 Europeans, 10,000 Chinese, 3000 Coreans, and 1000 Japanese. The principal merchants are Germans. The small shopkeepers are mostly Chinese. I asked a Chinese artisan how much he had to pay for his passport, and he told me twelve roubles per annum, so the Russian Government must make a good round sum in this way. Labour is dear, for the East. A bricklayer gets 1.50 roubles per day. The mixed population seems well kept in order. I could not but admire the police. I was greatly relieved when I found my passport awaiting me, and I promptly got it sealed by the police authorities. Being a Protestant missionary, I had to sign an undertaking not to proselytise.

On the 25th June I started by the eastern section of the Trans-Siberian Railway, and travelled by it as far as it is completed, namely, to Imann, on the Imann River, a branch of the Ussuri, a distance of about 200 miles. This journey took nearly twenty-four hours to accomplish. The line is badly laid, and the train runs very slowly. Long delays occur at the stations. Before starting three bells are rung at intervals, the guard whistles twice, and the locomotive twice. The cars, which are after the American style, are fairly comfortable, but are not kept clean. The railway officials are Russians, and I found them very obliging.

In general aspect the country is much like Northern Manchuria. It is undulating and hilly, the hills being covered with brushwood and small oak thickets. The village of Nikolsk, about sixty miles from Vladivostock, is said to be the place where the Trans-Manchurian line, running through Kirin and Tsitsihar, will join this one. By keeping the line north of lat. 44° many of the high mountains which I had to cross will be avoided. As far as I could gather, the line is to pass from Tsitsihar north-west to Mitrafanof beyond Stretensk, not taking in Aigun or Blagoveshchensk at all.

On the train I made the acquaintance of Captain Buanof of the Amur steamer *Blagoveshchensk*, and on arrival at Imann I booked by his steamer to Stretensk on the Shilka. The cargo was entirely rails and iron for bridges on the Trans-Baikal section of the railway. The steamer, like many on the Amur and Ussuri, is wooden and flat-bottomed, and propelled by a single paddle-wheel at the stern. When deeply laden it only draws 4½ feet of water. There was electric light on board; and the cabin I got, though too near the engines to be cool enough to sleep in, did very well for storing my baggage in, and I slept at night in the saloon. Owing to competition with the mail steamers, I got my ticket to Stretensk at the low figure of twenty-five roubles, and this included food.

We started the day after our arrival at Imann in company with a twin steamer belonging to the same owners, called the *Odessa*, and after a few miles the Imann joined the Ussuri. Having the stream with us, we made a rapid journey of thirty-six hours to Khabarovsk. This important town, which is the seat of the governor of the Maritime Province, stands on high ground just at the confluence of the Ussuri and Amur. It is said to have a garrison of 10,000 soldiers, which is, I should think, a third of the whole population. Besides Russians, there are between 2000 and 3000 Chinese, and several hundred of the aboriginal tribes—the Goldis as they are called, or Fish-skin Tartars. The church, and the triumphal arch erected on the occasion of the visit of the Czarevitch in 1891, are the chief features of interest.

After about two hours at Khabarovsk we turned westwards, and steamed laboriously up the Amur. The river Amur is here, five hundred miles from its mouth, at least a mile and a half wide. The Chinese call it the Black River, from the dark colour of its water. The Ussuri and Amur form the boundary between Manchuria and Russia, so, as we steamed upwards, we were following the frontier. On the Russian side at every few miles are villages, post and military stations. On the Chinese side the great primeval forests are unbroken.

VLADIVOSTOCK

TRAVELLING IN A TARANTASS THROUGH THE SIBERIAN FOREST

By the time I had been a few days on board I felt quite at home, and began to know the captain and pilot a little. They gave me much useful and interesting information, though, alas, my imperfect knowledge of Russian prevented me availing myself of their knowledge to the full. They told me they were both Dissenters, and not of the Greek Church, and that in the town of Blagoveshchensk, where they live, there are from 8000 to 10,000 Dissenters. They are not persecuted by the Government, and are allowed to meet for worshipping God according to their conscience; but they are not allowed to evangelise members of the Greek Church. I learned to sing one of their hymns, which struck me as peculiarly plaintive and quaint. They seemed to know a good deal of the New Testament.

In conversation with these men I learned the way in which the common people in Russia, even Dissenters, look upon our nation. They consider us clever, rich, and grasping, ever to be watched, and, if possible, checkmated in our political schemes of aggrandisement. Even the missionary enterprises of Great Britain are looked upon with suspicion, and are frequently openly asserted to be prosecuted for the extension of our empire. Anglophobia seems to be as acute in Russia as Russophobia is among ourselves. It is a great pity that it should be so. Doubtless there are faults on both sides, but I think it should be the aim of our statesmen more and more to convince Russia of our desire for friendship, and not to yield to the temptation, when Russia seems aggressive, to treat her as an irreconcilable foe. It seems to me that we have both many common interests in Asia, which by our jealousy of each other we may injure, and which by our friendly co-operation we could greatly advance.

The extent of the traffic upon the Amur and its tributaries is great and growing. I saw a dozen steamers before reaching Khabarovsk. There is said to be a mercantile fleet of over a hundred steamers, and as many barges, at present on the Amur and its branches. Captain Buanof and his brothers own four steamers like the one I travelled on. They were built at Blagoveshchensk, and the engines and machinery came from Germany. The ordinary carrying trade is principally up the river. Often the steamers coming down carry only pine or other wood. I saw very few British goods; they were mostly American, German, Japanese, and Russian. The trade is growing so rapidly that to meet its requirements six or eight new steamers are launched at Blagoveshchensk every year. The freight that Captain Buanof received for carrying rails from Imann to Stretensk was eighty-seven kopecks per pood (that is, about 1s. 9½d. per 36 English pounds). Some of the sailors on board were Chinese, and some were Russians. Both alike received thirty roubles per month of wages. (Rouble = 2s. 1d.).

The fare I got on board was principally potato soup with pieces of boiled beef in it, two or three times a day, tea in glasses, rye bread and rusks, and now and then fish, eggs, meat pies, and sour butter (*smetana*). The tablecloth could not be called clean, and the serviettes were handed round. Each one helped himself from the tureen in the centre of the table. A little more cleanliness and less roughness would not have been amiss, but we got along all right.

We did a hundred to a hundred and fifty versts in twenty-four hours against the current (verst = two-thirds of an English mile), stopping once a day for fuel. We burnt only wood—birch, oak, and pine being the commonest kinds, and costing from three to five roubles per cubic fathom, cut into blocks ready for use. About twenty-five cubic fathoms were consumed in the twenty-four hours.

For the first few days on the Amur the banks were low, flat, and covered with willows and rushes. On the Manchurian side a range of wood-clad mountains could be seen, twenty or thirty miles distant.

On the night of the 30th June we passed the mouth of the Songari. It is the largest branch of the Amur, and is navigable by light-draft steamers at certain seasons as far as Kirin. Of the other tributaries, I ascertained that the Zeia is navigable for 1000 versts, and the Bureia for 300 versts.

On the 1st July we reached the Lesser Khinghan range. These mountains abound in large game—tigers, bears, wolves, etc.—and are believed to be rich in minerals. They are covered, where the Amur pierces them, by virgin forests, and as we wended our way through them the scenery was entrancing. Now we steamed under bold, precipitous cliffs, and again the mountains widened out, only soon to close around us on every side. Doubtless the Amur scenery will by and by attract tourists from China and Japan, when better facilities for travel are provided. It is certainly well worth seeing.

Though the rainy season, which is usually in July and August, had not begun, we had occasional heavy showers, and the water in the river was pretty high. This, and the absence of fogs, enabled us to make a pretty good passage, reaching Blagoveshchensk on the morning of the 7th July.

This is the largest town in Eastern Siberia, having an estimated population of about 50,000. It stands on the left bank of the Amur, a little above the place where the Zeia joins it. The people are very proud of their town. It quite eclipses Vladivostock and Khabarovsk. The streets are wide and well made, and there are several handsome buildings, including a club, hotel, church, flour-mill, and large merchant houses. Of the latter the store of Messrs. Kunst and Albers is the finest. There is also a shipbuilding yard. This is the centre of the Amur gold-washing district. About 17,500 pounds of gold per annum pass through it to the Russian Government. Of course this is entirely from the Russian side. The Chinese side of the river is believed to have gold also, and I know that it has been found in considerable quantities in the Songari. If Manchuria becomes a Russian province, its gold will soon be discovered.

After spending a day in Blagoveshchensk we started again in the evening. The weather became very hot. It must have been 85° F. at least in the hottest part of the day. At night it was always chilly. Occasionally we had some magnificent coloured lightning, the purple-pink sheet variety being the commonest. Stinging insects gave trouble again, but were nothing to those on the road to Khunchun. When we stopped to take in firewood I seized the opportunity for a ramble in the

woods, gathering wild-flowers and getting exercise. On one occasion I miscalculated the time, and was almost left behind, but the captain saw me on the bank when the steamer was in midstream, and sent a boat off for me. I should not have cared to live a few days in that uninhabited Siberian forest.

About 300 versts west of Blagoveshchensk we sailed close to a cliff with several coal-seams in it. The coal has been burning as long as the captain can remember. West of this no oak trees were to be seen, and they are not to be found again till you cross the Ural Mountains.

One day I overheard the pilot humming a familiar hymn-tune. I asked him to bring his hymn-book, and was not long in discovering that it contained a number of Sankey's collection; and when I sang some of our old Scotch psalm-tunes he recognised a number. This made another bond of sympathy between us, and to the end of the voyage we were fast friends. I was told in Blagoveshchensk that a large part of the river trade is in the hands of Dissenters, like this man, who are much trusted and respected because they are temperate and cautious.

On the 12th July, when we were nearing the confluence of the rivers Shilka and Argun, which form the Amur, I noticed white flags on the left bank of the river. These, the pilot told me, mark the old route surveyed for the railway, when it was intended to carry it down the north side of the Amur.

On the 13th we entered the river Shilka. It is navigable by steamers as far as Nerchinsk; and the Argun, at favourable seasons, for about 700 versts.

The scenery on the Shilka, as on the Amur, is lovely. The weather became cooler as we ascended, and the bright skies, the green wooded hills all around us, the wild-flowers on the banks, and the fragrance of the larch and pine trees, gave me a very different idea of Siberia from what I had previously conceived. But every now and then we passed a convict settlement, and my thoughts wandered from the beauties of nature to the sad and dark-looking log prisons and their inmates. I determined to see the inside of one of them, and form my own opinion of the treatment of the exiles.

The whole way from Imann I had seen no cultivated ground, the villagers seemingly being entirely engaged in cutting fuel for the steamers. Now, however, as we came near Stretensk, I noticed cultivated plots and gardens, with beans, potatoes, cucumbers, etc., and we caught occasional glimpses of the post-road—"the Moscow track," as it is called—over which so many weary feet have passed into exile. We were now nearly 3000 feet above the sea, and the night winds became quite cold, so that I could not sit on deck.

On the 17th July we reached Stretensk. I had been twenty days on board, and Vladivostock now lay 1500 miles behind. Before me were 1300 miles of post-road travelling. Here I tried to find a travelling companion who would share my expenses, two travelling as cheaply as one on a Russian post-road. I discovered a Corean, seventeen years of age, bound for Irkutsk, and we agreed to travel together. He spoke Russian well, and I thought he was an acquisition, and would help me

when I could not make myself properly understood. Before many days passed, however, I found him so truly Corean—*i.e.* lazy—that I would have parted with him if I could.

My *poputchik* (travelling companion) and I went to the post-station, and found we could not have horses till next morning; so, after getting our baggage safely conveyed to the station, we took a stroll through the town. It lies on the right bank of the Shilka, and consists of a few rows of log houses, a small market-place, some soldiers' barracks, and a church. Returning to the post-station, we spread our mattresses on the floor and tried to sleep. It was for me perfectly useless. Like most Siberian houses, the station swarmed with bugs, and not being used to these companions, not one wink of sleep did I get.

In the morning we started in our hired *tarantass*, a conveyance which at first sight looked to me like a large perambulator. The fore and aft wheels are set as far apart as possible, and two long birch rods, stretched between the axles, support the cradlelike body of the machine. The back part of the cradle is prolonged upwards into a kind of hood. There is a box in front for the driver, but no seat of any kind inside. We packed our baggage and bedding inside, and I soon found the conveyance much to be preferred to a Chinese two-wheeled mule-cart.

We crossed the Shilka on a ferry-boat, which is swung like a pendulum from bank to bank by the force of the current. Then our Jehu whistled to his three horses, and off we went at a rattling pace. The roads could not be called good, but they were far better than Manchurian ones. Galloping, we did a verst in four minutes, and our average was ten versts an hour. Every twenty or thirty versts we had to change carriages, horses, and drivers. Each driver expects a tip. The way in which the *yemshchik* (driver) drives downhill at full speed in order to get up momentum to carry the vehicle well up the opposite hill was at first a little alarming, but we soon got used to it, and even entered into it with zest.

We reached Nerchinsk the same night, about nine o'clock, having done our first 100 versts in 14 hours. When horses are available, it is advisable to hire at once and push forward night and day, for one is pretty sure to have some enforced rests; so, though Nerchinsk is an important little town, owing to the silver and gold mines in the vicinity, and to its having a large convict prison, we preferred, as we got the chance, to go on, and before midnight we were on the road again. I soon gave up attempting to sleep at the post-stations, for, though whitewashed and having a semblance of cleanness, most of them are simply living with fleas and bugs. My provision-box again came in useful, as often we could find nothing to buy save rye bread and hot water.

Sanitary science is practically unknown in Siberian houses. The ceilings are low and the windows small and hardly ever opened. Proper ventilation can seldom be obtained. I preferred to spend most of my time in the open air.

The road led over grassy hills and through birch forests, till we reached the town of Chita. This is the capital of the Trans-Baikal

province, and has about 12,000 inhabitants. It stands very near the highest part of the great central plateau of Asia.

On the hills we saw flocks and herds of cattle and sheep, tended by Buriat shepherdesses. The Buriats, who inhabit this province along with the Tsaigans, are of the Mongolian type, with broad faces and high cheek-bones. They speak a language of their own, which is, however, akin to Mongolian.

We met a few caravans carrying *vodka* (Russian whisky) and tea, and passed a few small villages, but we traversed long stretches of uninhabited country. About six o'clock on the 22nd July we crossed the watershed of the Yablonoi mountains, and shortly after saw a few streams running west, the water of which, instead of going into the Amur basin, finds its way to Lake Baikal, and thence to the Arctic Ocean. I noticed on a finger-post "5919 versts to St. Petersburg." What a vast country is Siberia!

It was amusing to note that when I wished to urge my *yemshchik* to drive faster, any language answered the purpose. If I spoke in English, or in Chinese, and interjected a few Russian words with a scowl and a good deal of gesticulation, our speed accelerated at once. Another method was to say calmly, "*Yemshchik*, do you like to drink tea?" He usually understood the hint, and, with a whoop and a whistle and a flourish of his whip, responded in a convincing manner. Sometimes we had exciting races with other travellers to get first to the station to secure the horses.

We met two parties of exiles going east. Soldiers, with fixed bayonets, went before and behind the party. The men wore chains from their ankles to their waist, but were not fastened to one another, and the chains did not look heavy. The women and children and some who were footsore were in *telegas*. I did not think any of them looked as if they were badly treated; some of the faces of the prisoners looked very villainous. Both parties were bound for the island of Saghalin. They had come by the railway as far as Kansk, and were to get a steamer at Stretensk. When on the march they are not expected to do more than about 30 versts in the day, and at night they rest in wayside forwarding prisons.

We were fortunate, on reaching Verkhni-Udinsk, on the river Selenga, to find a tug-boat, the *Siberiak*, just leaving for Lake Baikal. We secured passages by her, and thus saved 130 versts of road travelling. On the steamer we got two great luxuries—a good wash and a good night's rest.

We left Verkhni-Udinsk in the evening, and almost immediately came to a large steel bridge in process of erection for the railway. Between Stretensk and Verkhni-Udinsk we saw several portions of the line nearly finished. I should think this section may be opened for traffic in about two years from now. Parts of the river Selenga are lovely, but they do not come up to the Shilka and the Amur.

After a short delay at the mouth of the Selenga, we got a wooden side-paddle steamer of about 600 tons, the *Yakof*, to take us across Lake Baikal. There are four Lake Baikal steamers. The engines of the one we crossed in were from Denny of Dumbarton.

Lake Baikal is very interesting. It is about 60 versts wide opposite the mouth of the Selenga, where we crossed it, and is nearly 400 versts long. We sailed for hours close to the western shore. On it precipitous and pine-clad mountains, from 1000 to 3000 feet high, come to the water's edge. None of the peaks had snow on it, but it was very cold. It was calm; but I am told that sometimes terrific mountain blasts lash the water into foam, and endanger navigation. It is the only fresh-water lake in the world which contains seals. Did they come up the Yenisei and Angara from the Arctic Ocean? The grandeur of the mountains, the solemn stillness, broken only by the splash of the paddles, and the solitude of Lake Baikal, can never be forgotten by me.

It was eleven o'clock at night when we reached Listvenichnaia, near the south-west end of the lake. Here customs officers examined our baggage, as it is on the direct route from Kiakta and Urga to Irkutsk. I slept all night on the landing-stage, a few feet from the water, and at daylight stepped down to the shingly beach, and washed in the crystal water. It was like iced water even on a July morning. We went on board a small paddle-steamer early in the day for Irkutsk, and soon we were rushing down the Angara. Close to where the Angara leaves the lake we saw a landing stage being built for the railway. As the part of the line round the south end of the lake will be very hard to make, it is intended temporarily to transport the train on a specially constructed steamer from this landing-stage across to the other side of the lake. The current of the Angara is very rapid, and the water is so clear that we saw the bottom everywhere, although it is in places more than thirty feet deep. I never saw such transparent water before. In four hours we came in sight of Irkutsk, the largest and best known town in Central Siberia. It stands on the right bank of the Angara, and looks quite imposing, as it has so many fine buildings, minarets, and domes. It has about 40,000 inhabitants, and the principal buildings are the old and new cathedrals, the other Greek churches, the theatre, the gold refinery, hospitals, hotels, and custom-house. There are also many fine private residences, such as the Governor's. The buildings are nearly all of wood.

The day after I arrived I called on the Governor, and asked permission to see the convict prison, cathedrals, etc. He received me with great courtesy, and deputed a gentleman in the Government service to show me everything I wished. I first went to the prison. Space does not permit me to describe in detail what I saw there, but the impression I carried away was that the prisoners were most humanely treated. The cells were fairly clean, the hospital wards were comfortable, and the little church charmed me. The prison fare, which I saw being cooked, and tasted, was wholesome and sufficiently nourishing. In the industrial department I saw prisoners who had chosen to work busy at their trades. They are provided with tools, and allowed to keep 60 per cent. of their earnings. I saw murderers and other criminals who would not have been so leniently dealt with in England. The political prisoners I saw were only residing there for a day or two. I was told that they were to receive practical freedom within certain boundaries, and to be allowed to

MARKET SQUARE, BLAGOVESHCHENSK

CONVICTS MAKING THE TRANS-SIBERIAN RAILWAY

go to the theatre, attend balls, and mix in society like free citizens. I do not refer here to the injustice of their being exiled at all. That I cannot discuss.

Next I went to the hospitals, and found that the doctors were men trained in European universities. They showed me all the departments, and everything was much more up to date than I expected to find in the heart of Siberia.

I attended service for the dead in the old cathedral, and though I could not understand one word, most of the liturgy being in Slavonic, yet the ritual, ceremony, and gorgeous vestments of the archbishop and bishops were most interesting.

I also visited the new cathedral. Its architecture is plain, but the bronze work inside and the paintings are exquisite. We also went to the custom-house, the gold refinery, the public gardens, and other sights of the town. My three days were much too short to see everything.

With another *paputchik*, a Pole, who was returning to Europe, I set out on the evening of the 29th July on my last *tarantass* journey. The road between Irkutsk and Kansk is much better than that east of Lake Baikal, and there is much more traffic on it, but the scenery is poor. We could seldom get post horses without waiting some hours; so, in order to get forward, we hired from farmers, paying a little more than the Government rates.

On the third day from Irkutsk the Pole and I parted company, as he was unwilling to travel so fast. I pushed on alone, often through dense birch and pine woods at dead of night without any lights, and occasionally overtaken by thunderstorms and drenching rain; but I could not brook delays, for my heart beat quick at the thought of soon being in Europe.

On the 4th August I reached Kansk, having done the 830 versts from Irkutsk in 5½ days, or an average of 150 versts per day. From Kirin to Kansk had taken me nearly two months. In a fortnight more I should be in Scotland. Between Irkutsk and Kansk the railway is well forward, and should be opened this summer. My Siberian post-road travelling had cost me about 100 roubles for 1300 English miles. If I had secured travelling companions all the way, it would have been less.

At Kansk I got the train, and it only cost me about 70 roubles, including my baggage, in comfortable second-class cars to Moscow.

Travelling on the Siberian railway has been ably described by Mr. J. Y. Simpson and others, so I may pass it over in a sentence or two. East of the Ural Mountains it is very slow, but the line is new, and often needs repairing, so it is advisable to be cautious. There are no restaurant cars yet on the trains, but the refreshment rooms at the stations are good, and plenty of time is allowed for meals.

The Kirghis Steppes reminded me of the prairies of West Canada, and were tame after the beauties of Eastern Siberia and Manchuria. Some bits of the Ural Mountains are beautiful, but will not compare with the Amur and Lake Baikal. European Russia was to me quite uninteresting, and I was glad when, on the 15th August, we steamed into

Moscow. After spending 2½ days in Moscow, I proceeded by rail to Warsaw, Berlin, and Hamburg, and thence by steamer to Leith. The whole journey from Kirin to Leith took 76 days, and only cost £75.

It was a most enjoyable and instructive trip, and I do not regret for a moment the fatigue, the time, and the money it cost.

The three things which perhaps impressed me most were the strength of Russia as a military power, the extent of useful and in parts beautiful but undeveloped territory she possesses in Siberia, and the great desirability to Russia of the sunny, fertile, and wealthy mineral province of Manchuria.

THE GEOGRAPHY OF ÆTOLIA.[1]

By J. W. M'Crindle, M.A., LL.D.

This work, which is an extension of the Essay for which Mr. Woodhouse was awarded the Conington Memorial Prize in 1894, records his travels and explorations in Greece, as Craven Fellow, in the years 1892 and 1893. Before undertaking his researches he had supplemented his Oxford learning by acquiring, as a student of the British school at Athens, a competent knowledge of Greek antiquities. From his perusal of the authors who had written upon Ætolia before Colonel Leake he had derived no benefit. They had lacked the absolutely necessary qualification of having been in living contact with the land itself, and hence in dealing with the classical texts which relate to it, and are often obscure and perplexed, they were involved in hopeless confusions and contradictions. No one, it thus appears, who has not been to Ætolia, can be in a position to criticise the present work, except merely with reference to its literary character. On this point nothing more need be said than that the style is clear and forcible, and full of colour where scenes of beauty or grandeur fall to be depicted, such as often meet the eye in Ætolia, which, like our own Scotland, is a land of the mountain and the flood. All then that we propose to do in this paper is to lay before our readers the salient facts regarding Ætolia, and more particularly the geographical, which we have learned while sitting as disciples at the feet of our accomplished author. The volume contains three main sections: (i.) Geography, (ii.) Ætolian tribes, (iii.) Topography and Antiquities. There are, besides maps and plans, many beautiful illustrations, several appendices, and a copious index. The volume is interspersed throughout with citations of classical texts concerning Ætolia, found in Thucydides, Polybius, Strabo, Livy, Pliny, and other writers. Their statements in these texts are, from their want of local knowledge, at times confused and erroneous, and Mr. Woodhouse's elucidations and corrections of them will be a godsend to future editors. The texts in question embrace nearly all the known facts of Ætolian history. Had a succinct narrative

[1] *Ætolia: its Geography, Topography, and Antiquities.* By William J. Woodhouse, M.A., F.R.G.S. The Clarendon Press, Oxford, 1897.

of these facts been strung together in their chronological sequence, this would have been, we cannot but think, a welcome assistance to the readers of the work generally. Let us now turn to the first section, which more immediately concerns us as a Geographical Society.

In ancient times Ætolia was divided into two districts—Old Ætolia and Ætolia Epictetos, or the Acquired, a name which indicates that it had been annexed to its neighbour either by conquest or persuasion. Old Ætolia was comprised between the Acheloös, now the Aspropotamo, and the Evenos, now the Phidharis, and extended northward from the gulf to the upper limits of the central plain. The boundaries of Ætolia, taken as a whole, Nature herself has very distinctly traced. The Aspropotamo, which comes from Epiros in the north and flows southward into the Ionian sea, determines her western frontier and divides her from Akarnania, her rival of old, but now conjoined with her in forming a division of modern Greece. From the Locrians, again, her neighbours on the east, she is divided by a rampart of mountains that extends from the sea northwards to Mount Veluchi—the classic Tymphrestos, or Typhrestos, an offshoot of Pindus, which, "towering at the head of the Spercheios valley, stands sentinel on the threshold of Northern Ætolia." The two frontiers converge in the Canton to which Agrapha, a place some sixteen miles north-west from Tymphrestos, gives its name. The space enclosed within these frontiers is thus roughly triangular, the coast line forming the base, and the apex falling in the north of the Canton just named, which is conterminous with the country of the Dolopians.

The northern section of Ætolia presents, in one respect, a striking contrast to the southern. In the former, the mountains and the other natural lines run from north to south, and in the latter run from east to west. There is, again, also a striking contrast between the shores of Ætolia and those of Achaia on the southern side of the gulf. For while the country from Corinth to Patras is studded continuously with pleasant villages and towns, and is but a garden in which every species of tree known to Greece flourishes in profusion, the opposite coast shows an arid waste of mountain-land apparently almost without inhabitant, and it is only where the Mornos has deposited the soil brought down by its waters that there is any considerable space between the sea and the mountains.

Mr. Woodhouse, proceeding to examine in detail the Geography of Ætolia, treats it under these four heads:—(i.) The plain between the sea and the chain of Zygos and the central plain; (ii.) The central watershed; (iii.) The river system of Agrapha; and (iv.) Eastern Ætolia, or Kravari, which comprises the basins of the Phidharis and the Mornos. The littoral plain has been formed by the deposits of the two rivers just mentioned and those of the Aspro. It is consequently narrow, seldom exceeding four miles in width, but expands as it stretches westward to the Aspro, the largest of the rivers. This region is the Old Ætolia which was known to Homer, and which was so famous in mythic story. Here were the woods wherein all the mighty chiefs of Hellas were gathered together to risk life and limb in the hunting of the Kalydonian

boar, and here too were the scenes adorned with the legends which cluster round the names of Acheloös, Œneus, Althæa, Tydeus, Meleager, Deianeira, Thoas, Diomede and other heroic figures. The plain, which lay beneath the heights of the Zygos or Arakynthos, was, in these old days, extremely fertile and a seat of such wealth, power, and splendour that Ætolia was then regarded as the ornament of Greece. Five of its cities are named in the *Iliad*: "Pleuron, Olenos, Pylene, Chalkis near the sea, and rocky Kalydon," cities which, between them, contributed forty ships to the expedition against Troy. When Ætolia is next brought to our notice it is in the pages of authentic history, and she there appears shorn of all the splendour of her early days. Thucydides speaks of the people as sunk in barbarism and living by robbery and piracy. One of the tribes was even accused of cannibalism. The soil of the coast tract is still fertile, but from the sparseness and poverty of the population and the backward state of agriculture it is for the most part at present an unredeemed waste. The capital, Mesolonghi, is a modern town, but, though unhallowed by any old historic memories, it has yet an undying fame in connection with the war of independence, and, more than all, as being the place where Lord Byron, after his stormy career, found an "honourable death and took his rest."

It is built on the edge of a shallow lagoon at the distance of four miles from the sea, with which it has now communication by means of a causeway constructed through the lagoon. The poet just named called it a *mud-basket*, but the town has been greatly improved since his time. Besides Mesolonghi, the only other place of importance on the coast is Naupaktos—a city of old renown, lying near the mouth of the Mornos, where the Heraclidæ built the fleet in which they crossed the gulf for the conquest of the Peloponnese. It belonged to the Athenians in the days of the Peloponnesian war, and it was thence that Demosthenes set out on his ill-fated expedition against the tribes in the interior. Its harbour is now so choked up that it cannot receive the larger sort of craft that navigate the gulf. It is called Epakto by the Greek peasants, but is better known under its Italian name of Lepanto.

Besides the lagoon we have mentioned, which extends from the Phidharis westward to Cape Skrophes near the mouth of the Aspro, a distance of eighteen miles, another which is long and narrow runs northward into the interior. Half-way up this lagoon and in the middle of its channel is situated Anatolikon, at a distance of six miles from Mesolonghi, which at one time it threatened to outrival. Towards the northern extremity of this lagoon there occurs to the east of it a remarkable fissure in the Zygos—the pass of the Kleisura—which opens a road through the mountain into the central region where two lakes fill the depression, the smaller on the west called the lake of Angelocastro, and the larger (which is twelve miles in length from east to west) called the lake of the Apokuro, or lake of Agrinion, the ancient lake Trichonis. The town of Agrinion (or Vrachori) stands to the north-west of the lake between the river Eremitsas and the Aspro, and is described as a beautiful place which has been greatly improved during the last few years. Tobacco-fields, vineyards, and gardens are dispersed among the

houses, and it is, besides, the present terminus of the railway of Northern Greece. Our author speaks in rapturous terms of the beauty and fertility of the plain stretching along the northern shores of the larger lake; its rich crops of maize and tobacco tell of prosperity and wealth, while the ruins testify to an equally flourishing state of things in ancient times. The notice of it concludes thus:—"Blessed as it is with a pure and healthy air, a fertile soil, a perennial water-supply, and fenced round with mountain barriers, we feel that this region, three-and-twenty centuries ago, must have been the real heart of the Ætolian land and the home of its most powerful chieftains."

In this central region lay Thermon, the place where the general council of the Ætolian League held its annual meetings, and where the national memorials and the best specimens of native art were to be found. Our author locates it differently from Leake and Bazin, who fixed its site at Vlochos, a place some four miles distant from the north-west end of the larger lake. Much space is devoted to the discussion of this question, and we are led to accept, without reserve, the view of Mr. Woodhouse that Thermon, which was plundered and destroyed by Philip v. of Macedonia, is to be identified with Palaiobazári which stands on a plain at the foot of a hill near Kephalóvryson—a place not far distant from the eastern end of lake Trichonis,[1] and memorable as the spot where Mark Botsaris fell, the best and most disinterested of all the leaders who took part in the War of Independence. Polybius has described the route by which Philip led his army from Akarnania to the Capital of the League, and Mr. Woodhouse was led to his conclusion by comparing the data supplied by that author with the natural features of the country round the lake and with the sites of ruins he found it to contain.

The region beyond Agrinion, between the Aspro and the head-waters of the Phidharis, is one of the wildest in Ætolia. "All is mountain, a bewildering and savage land of peaks and ravines that defy description. The roads are narrow and often dangerous, along dizzy slopes above the gorges." This is the region of the great watershed. The mountains to the south of it run from east to west, and those above it from north to south. When it is crossed the traveller reaches Prossós, a large village of 1200 inhabitants, famous for a monastery founded in the ninth century, to which pilgrims resort annually in great numbers. The hills in the west of this region are not so elevated, and are no longer of limestone but of soft sandstone formation. Though clad with vegetation, their forms are so monotonous and uninteresting that they sadden the spirit of one who threads his way through their recesses. In Northern Ætolia the rivers, like the mountains, run from north to south. The capital is Karpenisi, which lies at the base of Mount Veluchi or Tymphrestos, and is celebrated for its great annual *panegyris* or fair. From the summit of Veluchi, under favourable atmospheric conditions, a magnificent view over Thessaly and Ætolia, from the Ægean on the one side to the Adriatic on the

[1] Inscriptions quite recently discovered *in situ* have proved the correctness of this identification.

other, can be gained—"a view," as the natives say, of "all the world." Most of the ancient sites in North Ætolia lie along the course of the Acheloös on both its banks; and, indeed, there are few regions in Greece that are so thickly covered with ruins as the wild district between the point where this river is joined by the Platanias and that where it is joined by the Patiópulos, that is, where the great bend in its course occurs.

Eastern Ætolia, comprising the Canton of Krávari with the basins of the Phidharis and the Mornos, is described as a high rugged country, with its mountains so arranged as to make travel and communication very difficult. The land, like that in the Highlands of Scotland and the west of Ireland, supplies very scantily the means of subsistence for the population, and hence the younger sons of a Kravarite family are obliged to emigrate, and they generally go to seek their fortune in Turkey. Should they find it, they return to spend the evening of their days in their native mountain homes. From every part of Krávari a background to the view is afforded by the summits, on the eastern border, of Vardhúsi and Kióna, which attain an altitude of more than 8000 feet.

The geographical section of the work concludes with a chapter on the geological structure of the area described, and this is rendered all the more interesting as our author takes occasion to indicate the influence of the physiography of Ætolia in determining its historical development. The second section of the work attempts to determine, with as much precision as the scanty sources of information allow, how the ancient Ætolian tribes were respectively located. On the shore of the Gulf lived the Ozolian Lokrians. Immediately above them were the Apodotoi. Beyond the River Daphnos, the Bouttioi and Ophioneis, with the Kallieis and the Bomieis on the east and the north. Above Old Ætolia were the Eurytanes on the east, and the Thestieis and the Aperantoi on the west.

The last section forms the main bulk of the volume, and describes in detail the Topography and Antiquities of Ætolia. The ruined sites were numerous, but, generally speaking, the remains found in them showed that the art productions of Ætolia were of an inferior order—even inferior to those in Achaia. The author's predecessors who had accomplished most in this field of research were chiefly Colonel Leake and M. Bazin. The investigations of the former were almost entirely restricted to Old Ætolia, and these resulted in the satisfactory identification of nearly all the most important sites in that district. "We marvel," says our author, "at the precision with which he assigns their names to the remains—Chalkis, Kalydon, New and Old Pleuron, Proschion, Paianion, Konope, Lysimacheia, Trichonion." Bazin's investigations ranged over a wider field, but many sites escaped his notice. We cannot but think that Mr. Woodhouse has exhausted his subject, and that his work will remain the standard authority thereon.

THE THIRD ITALIAN GEOGRAPHICAL CONGRESS.

On the 12th of April the members of this Congress, to the number of more than three hundred, met in the Aula Magna of the Istituto di Studi Superiori, Florence. After the due installation of a president (Prof. G. Marinelli), vice-presidents (Major-General Vigano, Prof. Dalla Vedova, Prof. Millosevich, and Prof. Stefanelli), and secretaries (Cavaliere Roncagli, Dr. Bonaschi, the advocate Masini, and Prof. D. Vinciguerra), the Congress was opened in the name of H.R.H. the Prince of Naples by Prof. Marinelli, who thereafter introduced the Syndic of Florence (Marchese Torrigiani), by whom, on the part of the Municipality, the delegates were hospitably welcomed.

Prof. Marinelli then delivered the inaugural address, indicating the revival of geographical study among his compatriots, the necessity for its more vigorous prosecution, if only to avoid disastrous experiences in colonial developments, such as had recently occurred, and the gratifying proof of the increasing interest it commanded in the attendance at this third Congress, more numerous and influential than at either of its predecessors. He concluded a loudly applauded discourse with a stirring appeal on behalf of the more extended and more scientific recognition of geography in Italy's national schools.

He was followed by the Under Secretary of State in the Department of Public Instruction, Signor Bonardi, who, after felicitous allusion to Tuscany's past contributions to geographical discovery, culminating in the speculations of Toscanelli and the voyages of Vespucci, whose fourth centenaries Italy was about to celebrate, passed on to the educational value of geography, pledging the department in which he held office to the promotion of its interests in every way possible. Thereafter the Congress adjourned to the Palazzo Vecchio, where in the magnificent rooms of the Quartiere d'Eleonora di Toledo, the Marchese Torrigiani received the delegates, called their attention to the wonderful geographical maps of Danti and the frescoes of Bartolommeo Ghirlandaio, and afterwards entertained them at a sumptuous refection.

Next day the Congress proceeded to business in the four sections over which its work was distributed :—The Scientific (president, Prof. Fiorini of the University of Bologna); The Economic and Commercial (president, General Pozzolini); The Didactic (president, Prof. Dalla Vedova); and The Historical (president, Prof. Paoli).

In the first of these, Prof. E. H. Giglioli read a paper "On the Opportune Revival in Italy of Oceanographic Research." Much attention was evoked by the author's demonstration that other interests besides those of geography and biology, geology and physics, were involved in the prosecution of the subject. "But a few weeks ago," he said, "my illustrious friend, Prof. John Milne, the most learned of living seismologists, put it in evidence that in the great submarine abysses reside the causes of the terrible earthquakes which desolate now this, now that, continent." Then followed a historical survey of oceanographic research, in which the contributions of British investigators were fully and generously appreciated. Of this important paper, I send to the Society the original in printed form, merely adding that in the discussion it started, the Padre Bertelli, of the Roman Observatory, and Commander Cattolica, Director of the Hydrographic Department of the Royal Navy, took effective part.

In the second section, Dr. Giacomo Gorrini urged the necessity of a thorough examination of the origin and successive stages of the attempts made in Italy under her various rulers to establish colonies, with a view to (1) transportation; (2) emigration and relief of congested centres; (3) commercial expansion; and (4)

"colonie politiche" (political colonies). Again, by the kindness of the president, I am enabled to send this paper in print; while, as to the discussion it evoked, Prof. Guido Bigoni, of the Royal Lyceum of Genoa, may be said to have borne the chief part, calling particular attention to the Italian littoral on the Red Sea and in Somaliland, as yet awaiting profounder and more extended studies.

The first and second sections were then combined to hear a lecture by Commander Cattolica on "The Methods followed by the Hydrographic Office of the Naval Department in the Design and Reproduction of Charts." An official report of this able study will appear in the *Atti* of the Congress, shortly to appear.

At 9 P.M. of the same day (13th) the Aula Magna of the Istituto di Studi Superiori was crowded in every part to hear Signor Weitzecker discourse on "Basutoland and its Inhabitants." Introduced by a glowing eulogy from the president, Prof. Marinelli, the lecturer gave vivid illustration of the characteristics, ethnographic, linguistic, historical, and geographical, of that region of Southern Africa, and dwelt instructively on the progress made by its inhabitants through civilising contact with Great Britain. That people, which seventy years ago was cannibal, now sent its children to school, where they learned with such avidity and intelligence that they might (said Signor Weitzecker) compete at no disadvantage with their contemporaries of European origin—and, indeed, before the British examiners, acquitted themselves most creditably. Herd boys, after stalling their cattle, attend night-schools, often riding to them on oxen a journey of two or three hours when the moonlight admits of it. Among the Basutos are missionaries who co-operate effectively with their European brethren; acquiring, for professional purposes and special application, the exact sciences, and translating into their vernacular some of the most instructive and attractive products of European literature. Signor Weitzecker concluded his brilliant narrative of experiences, which will soon be made *publici juris*, with a fervent hope that not with exterminating wars but with science, with civilisation, with all the redeeming and regenerating influences of "the younger day," the disinherited ones of the earth, the laggards in the march of progress, will, like the Basutos, reinforce ere long the ranks of an expanding and ascending humanity.

The following day (14th) was chiefly notable for the sitting of the Economic and Commercial Sections, in which Prof. E. Millosevich discoursed on the "Supreme Necessity of Completing the Determination of the Area of the Italian Kingdom." His paper I am also sending to the Society as revised by himself for the printer; but its contents and the animated discussion it caused (in which the military delegates chiefly distinguished themselves) I cannot enter into, any more than into the cognate subject introduced by Prof. Dalla Volta on the "General Census of the Kingdom and its Execution." The two themes were of exclusive and, at the same time, of urgent, Italian interest—a fact which explained the restriction of the attendance mainly to delegates from the various cities and seats of learning in the home country.

In the afternoon, favoured by weather worthy of the best traditions of the Tuscan *primavera* (spring), an excursion was made to Fiesole, where the admirably excavated Roman Theatre, the Roman Baths, the Cyclopean Walls, and the Etruscan Museum, competed with the noble panorama for the admiration and delight of the delegates. After Fiesole the *Congressisti* in nearly their full force (300) took the mediæval stronghold of Vincigliata on their way home, and enjoyed an instructive object-lesson, due to the learning and liberality of Mr. Temple Leader, in the fortified abode of a mediæval *Condottiere*—the part played by its original owner, Sir John Hawkwood, the well-known English free-lance in the pay of the Tuscan Republic.

The 15th was signalised in the Economico-Commercial Section by Signor Angiolo Cossu, an able young Sardinian geographer, who read a paper on the "Distribution of the Population of Sardinia according to the Geological Constitution of the Soil." He showed how the depopulation of the island must in great part be attributed to the insalubrity of the land along its littoral. Remarking that while the mean density of the population of the island is 28 inhabitants to the square kilometer, he said that it rises, in an internal zone of Miocenic character, to 102 per square kilometer, thus attaining a density equal to the most populous regions of Italy, like Lombardy and Campania. This phenomenon he admitted must be chiefly ascribed to the better agricultural qualities of the Miocene, while the more recent soils which surround it, and which are so sparsely populated, are of much inferior quality. But he also traced such an enormous difference to the natural unhealthiness of the later soils, and to the flight of the inhabitants during past centuries into the interior of the island to escape the pirates whose incursions devastated the littoral and caused its abandonment. Signor Cossu's paper was followed by a very attractive one (at least for the Italian delegates), on "Italy as an Ethnic and Economic Factor in the Development of South America." Fourteen years' life in the Argentine Republic had enabled the author (Signor Godio) to estimate the progress made on the Plata by the Italian element, and how much greater that progress would be if the emigrants were duly backed up by their Government, and if not only labour but also capital were sent out to reinforce the national energies in Argentina. A practical issue from this warmly applauded paper was the carrying of resolutions in favour of the better teaching of South American geography in Italian schools, and also of the bestowal of greater attention on the Spanish language—the chief medium of communication in those latitudes. A third resolution in behalf of lightening fiscal burdens, so as to admit of the freer flow of Italy's capital towards those regions, was also approved, but with modifications proposed by the president of the section. Of cognate (and also of purely Italian) interest was the advocate Careri's memoir on "Geography as a Factor in the Legislative Function of the State," in which he dwelt on the disillusion of Italy, who had hoped that after the cutting of the Suez Canal her mercantile prestige would return to her, forgetting, as she did, her deficiency in capital, which makes her mercantile marine give way in all directions to foreign competition, and by damaging her merchant service deprives her navy of a healthy recruiting ground.

In the evening (15th) Dr. Lamberto Loria, in the Aula Magna, delivered a lecture on the War of Logra (New Guinea), illustrated with numerous photographs representing indigenous types, with costumes and warlike appurtenances. As it would be impossible to do justice to this brilliant exposition in my report, I shall confine myself to certain interesting details of Loria himself and his various expeditions in the Malay Archipelago, reserving an account of his lecture for a future number.

Dr. Lamberto Loria is a Tuscan by birth, and distinguished himself in mathematics at the University of Pisa, where his splendid physique, his versatile abilities, his ardent temperament, and, I should add, his ample fortune, made him a leader among his fellow-students. Some years ago, when the Anarchist conspiracy in Tuscany caused the Government such anxiety, Loria headed a university *comitato* to co-operate in its suppression, and his action received special commendation in Parliament. Master of his time and movements, he turned his attention to geographical exploration, and in the June of 1889 embarked on a Dutch vessel at Batavia (Java), and after a tedious voyage landed at Port Moresby, the seat of the British Government in New Guinea. From this, as his headquarters, he made

frequent excursions into the heart of the island, visiting tracts previously unexplored, and crossing occasionally to Australia to recruit his health, which suffered not a little from the fatigues and privations he endured. He visited nearly every British possession in Malayan waters, with a view to completing his collection of zoological, ethnographical, and anthropological types—his last and most important expedition in New Guinea being organised (like its predecessors) at his own expense, without any assistance from the Italian or British Government but their moral support. The island being destitute of mammals (except marsupials), no means of transport was possible but porters, and the baggage had to be conveyed on the shoulders of natives. This caravan consisted (besides himself and his immediate retainers) of a European *preparatore* (expert in scientific preparations, anatomical, zoological, and botanical) and of 200 porters of both sexes, as to whom Dr. Loria found that the heaviest and severest work was best discharged by the females. To visit the various islands, particularly those grouped at the eastern point of New Guinea, he purchased a merchant ship, and equipped it with crew and provisions for several years. During a long sojourn among cannibals he had never occasion to kill one of them, though often in danger of his own life—dangers incurred by his frequently intercepting expeditions made inland by those man-eaters with a view to capturing prisoners and devouring them. His moral force rendered physical interference unnecessary in the prevention of those gruesome campaigns, the after-scenes of which had filled him with horror. A more than usually successful take of prisoners would (he had witnessed) be followed by a most brutal *festa*, in which the cannibals tore their human victims out of each others' hands, wrenching off limbs, upper and lower, in the struggle, and devouring them—the said victims having been previously tortured and cooked alive in anticipation of the infernal meal. Many, and most instructive, are the collections sent or brought home from the Malayan Archipelago by Dr. Loria—the zoological being deposited at the Museo Civico of Genoa, numbering some fifty new species, and having already furnished the theme of twenty-five monographs by as many scientific experts. The ethnographical specimens are accommodated at the Kircherian Museum in Rome. These are so numerous that they fill several spacious halls of the Museum, and await Dr. Loria's more intimate study and classification. His anthropological collection includes above 500 crania, which are also on view in Rome, in the Museo Nazionale di Antropologia. Other important treasures are his *herbacine* (mosses), now in the hands of Dr. Levier, who has come upon eighty per cent. of new species among them.

In the Scientific Section (15th) Professor Marinelli explained the work of the International Commission for the Study of Glaciers, and also that of the National (Italian) Commission. Other communications of a more or less technical character were made in this section—such as that of Dr. Halbfass on "The Morphometric Study of Lake Orta"; that of Dr. Baldacci on "The Geographical Botany of Albania"; and those of Colonel Moni, Professor De Stefani, and Professor O. Marinelli on "Movements of the Soil."

A lecture at 4 p.m., in the Aula Magna, by Professor Ghisleri, on "The Teaching of Geography in the United States of America," attracted a numerous audience Profoundly interesting and instructive to Italians, it amounted to a eulogy of America's keen and comprehensive appreciation of the value of geographical study, as shown in many schools visited by Professor Ghisteri at the time of the Chicago Exhibition. The contagion of such an example, he concluded, would prove life-giving to Italy, whose genius for geographical research, long slumbering, was now fully revived.

Motus in fine velocior! I must close my summary (necessarily incomplete) by

a few rapid side-glances at features of the Congress, important in themselves, and capable of rewarding more intimate study in the official report of the proceedings now preparing for distribution to the delegates.

First to claim notice was the Mostra Geografica (Geographical Exhibition), held in the Lung' Arno Acciaioli, on the premises of the well-known antiquarian bookseller, the Cavaliere Leo S. Olschki. Among its treasures was the *Mundus Novus* of Amerigo Vespucci (1504, in quarto). The same most interesting work was on view in a German translation by Jobsten Ruchamer, printed at Nuremberg in 1508. In addition to many other books of unique value might be noted the *stupende edizioni* of Ptolemy, from the precious Roman edition of 1490 to the Paduan of 1621. Leaving these and many suchlike temptations to the Jonathan Oldbucks of the Congress, we pass to the Mostre Cartografiche, filling eight halls of the Royal Archivio di Stato at the corner of the Via Ninna, and attracting us with the *Planisfero del Secolo XIV.*; the maps of the Azores by Trixeira (1587); the *Carte Nautiche dell' America del Damel* (17th century); the map of the North Pole (17th century); and also the Indian charts of the same epoch. Documents of extreme historical value, relating to Amerigo Vespucci; an autograph letter of Toscanelli on the comet of 1453; and the precious edition ("the only complete copy extant") of the *Grands et Petits Voyages de De Bry*, lead on to a very rich collection of plans of mediæval Italian towns, most serviceable to the historian—all bringing back the Italy of the pre- and post-Renaissance with a vividness almost painfully impressive. This wealth of literary and cartographic works is at its best when illustrating the Vespucci and Toscanelli epoch, in view (naturally enough) of the celebration of the fourth centenary of those geographical pioneers which opens to-morrow.

To-night (April 17th) a banquet will be held at the "Gambrinus-Halle," at which the President, Professor Marinelli, and the heads of the sections are expected to speak; while a cordial despatch will be sent to the Syndic of Milan announcing that the fourth Italian Geographical Congress, in 1901, will be held in the Lombard capital.

J. P. Steele, B.A., M.D. (Edin.),
Delegate of the Royal Scottish Geographical Society.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lectures delivered in April.

Mr. William Ogilvie, Dominion Astronomer and Land Surveyor, lectured in Edinburgh, on April 5th, on "The Geography and Resources of the Klondike Region." Professor Prothero presided.

On April 29th, Professor Geddes gave an address to the Society, in Edinburgh, on Cyprus. Dr. John Kerr took the chair.

Lectures in May.

Two Lectures will be given in Edinburgh during the month. Mr. De Windt will give an address entitled "Through the Gold-fields of Alaska to Bering Straits" on May 17th; and on the 26th Major Stanley Paterson will, it is hoped, describe his recent journey in the basin of the Upper Orinoco.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Augmentation of the Delta of the Po in the Nineteenth Century.—It is well known that the waters of the Adriatic formerly extended farther to the west than they do at present, that Ravenna and Adria were maritime towns, whereas they are now several miles from the sea. History, tradition, the study of the rivers, and the measures taken by the Republic and succeeding forms of government to prevent the lagoon of Venice being silted up, all testify to the continued encroachment of the land, and show that considerable alterations have taken place during recent times. The calculation recently made of the area of the kingdom of Italy shows an increase of land between Porto Buso on the Austrian frontier and the parallel of 44° 20′, north of the mouth of the Savio, of not less than 29·83 square miles, when compared with the measurement of 1884. The latter, as regards the Venetian territory, was made on an Austrian map, first published in 1883, but based on surveys executed between 1808 and 1817, whereas the surveys for the new map of the kingdom were executed in 1893, so that the increase mentioned corresponds to a period of more than seventy years. With the object of ascertaining exactly where the extension of area has taken place, Professor Marinelli drew the line of the coast, as shown on the sheets of the new map, on that of 1883, and measured the enclosed areas with a planimeter. It then appeared that the movement in the outline of the coast has not been everywhere in the same direction, but that in some places the sea has gained on the land. As shown by Professor Marinelli's table in the *Rivista Geogr. Italiana*, Ann. v. Fasc. I., the total increment of land is 33·32 square miles, while the sea has spread over 3·49 square miles, reducing the gain of land to the 29·83 square miles set down above. Of this area 20·59 square miles are due to the alluvium of the Po itself.

ASIA.

The Population and Emigration of Japan.—The *Revue Scientifique*, Nov. 12th, 1897, gives figures relating to the movement of population from official statistics published in Japanese journals. The increase in the population has been very marked in the north-eastern part of the country, but, the density being very small compared to the area, there are extensive tracts still to be occupied, and consequently the emigration is small compared to that from Central Japan and Kiu-siu. The total emigration was 15,017 in the years 1885-89, and 38,462 in 1890-94, of which 12,221 migrated to Hawaii in the former period, and 21,625 in the latter. Few Japanese emigrate to the southern isles and Australia, for, besides racial prejudice, they fear the climate. As an example, 305 Japanese landed at Fiji in May 1892; in a few months 106 of them were carried off by beri-beri, fever, etc. Censuses have frequently been taken in Japan. In the year 610 the number of inhabitants was 4,988,842; in 1723 it had risen to 26,965,622; early in this century (1815) it was rather less, namely, 26,621,957. After this it steadily increased, reaching 35,929,060 in 1880, and 41,388,313 in 1893. The results of the censuses of 1894 and 1895 are not yet known, but probably the population has risen to forty-two millions. The annexation of Formosa has added more than three million subjects to the Empire.

The Lindoe Lake in Celebes.—This lake was, Professor A. Wichmann states, first mentioned twenty years ago by S. C. J. W. van Musschenbroek, who, on the strength of information obtained from the natives, assigned to it a greater area than the Limbotto lake, and affirmed that it was drained by the Saoesoe river into the gulf of Tomini. It has recently been visited by the missionary, Alb. C. Kruijt, and his account is published in the *Tijdschrift van het K. Nederl. Aardrijkskundig Genootschap*, Deel xv. No. 1. Having travelled from Posso, on the gulf of Tomini, to Parigi, and thence crossed the mountains to Paloe bay, Heer Kruijt wished to return to Posso by Lindoe and Napoe, but the prince of Sigi would not allow him to cross the country of the wild Napoe tribes, and therefore he was obliged to return from Lindoe to Paloe. Bora, the capital of the powerful state of Sigi, lies four hours' journey from Paloe. After a sojourn of seven days in Sigi, Heer Kruijt proceeded southwards, and in four and a half hours reached the Pakoeli country, and entered the wretched village of Sakedi. Here unite three rivers to form the river of Paloe. A short distance to the south of Sakedi the Korondjopoe falls into the Goembasa, which drains the Lindoe lake to the south-east, and close by the village the latter receives the Mijoe, coming from the south. These rivers are said by the natives to be rich in gold. Below the junction the river of Paloe (or Palos) is thirty to forty yards broad, and has a maximum depth of four feet. It spreads itself out as it advances towards the sea and forms a number of islands. It is navigable down to Paloe, which can be reached in a few hours, but, owing to the current, the journey up stream takes three days. By the valleys of the Mijoe and its tributaries Heer Kruijt ascended to a height of 4490 feet, and then descended to the brook Pantaoewa, which flows into the Lindoe lake, finally reaching the village of Sangko on the shore.

The lake is egg-shaped, the longer axis five and a half miles long, running from north-west to south-east. The depth Heer Kruijt could not ascertain with certainty, as the natives would not allow him to take soundings, but, as the water is brownish, fish can be speared in the middle of the lake, and the ducks seek their food there, while the Goembasa is an insignificant stream, he concludes that the lake must be shallow. Fish are very abundant. The general appearance of the country shows that Lindoe cannot be a crater lake. The surface lies 3200 feet above sea-level. A small island lies in the lake, named Bola ; it is approximately square, each side measuring about a furlong, and it lies about twenty yards from the south-western shore. A few houses stand on the island, to which the Tolindoe resort to hold festivals and in time of war. These natives, who well deserve the name of savages, occupy nine villages around the lake.

AFRICA.

The Census of Egypt.—A preliminary report of the census taken on June 1, 1897, has been presented to the Society by the *Société Khédiviale de Géographie*. The total number of inhabitants is 9,734,405, whereas at the previous census of 1882 it was 6,813,919, so that the increase during the interval of fifteen years has been 2,920,486, or at the rate of 2·76 per cent. *per annum*. At the beginning of the century the population was only 2,460,200. The males number 4,947,850, and the females 4,786,555. The large majority, 94·1 per cent., of the inhabitants have fixed abodes, 0·9 per cent. (88,671) are nomads, and 5 per cent. semi-nomadic. The population of Cairo is 570,062 (374,838 in 1882), of Alexandria 319,766 (231,396 in 1882). Tantah has increased from 33,750 to 57,289 ; Port Said from 16,560 to 42,095 ; Assyût from 31,398 to 42,012 ; Zagazig from 19,815 to 35,715.

Most of the other towns show a considerable growth, while a few, owing to very evident causes, have diminished.

The East Africa Protectorate.—A *Report* by Sir A. Hardinge on our territory in East Africa was issued at the end of last year. Constituted in its present form on July 1st, 1895, the protectorate is bounded on the south-west by the Anglo-German frontier, which, starting from the mouth of the river Umba, runs in a generally north-western direction till it strikes the eastern shore of the Victoria Nyanza on the first parallel of south latitude. On the north and north-east it is bounded by the Italian sphere of influence, the dividing line following the river Juba, and stretches up to the parallel of 6° N. lat. The boundary between the East Africa and Uganda protectorates is only partially defined; from the German frontier it follows the river Guaso Masai as far as Sosian, and then runs in a northerly direction along the Leikipia escarpment of the great meridional rift. The island boundaries being still uncertain, the area cannot be stated with exactness, but it may be put down roughly at 280,000 square miles. The coast-line is 405 miles long, and the greatest breadth of the territory, measured from the centre of the Gosha district on the Juba to the Leikipia escarpment, is 460 miles.

British East Africa includes three distinct sovereignties—the mainland territories of the Sultan of Zanzibar, the Sultanate of Witu, and the old chartered territory of the Imperial British East Africa Company, together with the remainder of the region between the Tana and the Juba not included in the other divisions. The mainland dominions of the Sultan of Zanzibar consist of a strip of coast land ten miles deep, extending from the mouth of the Umba to Kipini on the Ozi, of a series of islands off the coast between the Ozi and the Juba, and of the mainland town of Kismayu, with the land within a radius of ten miles round it. The State of Witu extends along the coast from Kipini to Kwaihu, and on the north is bounded by a line running due west from Kwaihu to a point a few miles east of the Ozi river.

Though these three political divisions cannot be ignored from a political point of view, they could not serve as a basis for administrative divisions. In dividing the country into provinces and districts, regard has been had to the physical features, tribal boundaries, and means of communication. The province of Seyyidieh includes the whole territory of the Sultan of Zanzibar, with the exception of Lamu, Kismayu, and a few miles of coast land north of the Tana, and extends inland to the Taru desert, which begins at a distance of 50 miles from the coast. It contains all the Arab and Swahili population between the German frontier and the Tana, and the whole of the kindred native tribes known under the common generic name of Wanyika. Its capital is Mombasa, and it is divided into three districts, namely, Vanga, Mombasa, and Malindi.

Tanaland extends along the coast from Seyyidieh to Port Tula. On the west it is bounded by a line running from the north-west corner of Seyyidieh through the desert between the Athi and Tana valleys to the grand falls of the Tana, and on the east and north-east by a line running from Port Tula to the Lorian swamp. It comprises three districts—Tana River, Lamu, and Port Durnford—and the Sultanate of Witu.

Jubaland, between Tana River and the Juba, extends nominally as far as the sixth parallel of north latitude, but at present contains only two districts, the Kismayu or Lower Juba, and the Upper Juba or Ogaden and Gosha district.

Ukamba, so called after the most important tribe inhabiting it, stretches from the rear of Seyyidieh to the boundary of the Uganda protectorate, and is subdivided into the Teita and Taveta, the Atla or Machakos, and the Kenia or

Kikuyu districts. About 160,000 square miles towards Lake Rudolph are not yet included in any province.

The population of the Protectorate may be estimated at about 2,500,000, more than half of whom are of pagan tribes. The Swahilis number fully 76,000, while the remainder is made up of Arabs, Indians, Europeans, and slaves. The population of the territory under effective control is composed of vigorous races, and if they continue to be protected from the destructive effects of alcohol will probably increase. Parts of the country are arid wastes, but other districts, notably Ukamba proper and Kikuyu, are exceedingly fertile and suitable for cattle-breeding and crops of almost all kinds, while the climate, owing to the elevation, 6000 to 7000 feet above sea-level, is healthy, with a mean temperature of 65°.

Sir A. Hardinge's report also contains returns of imports and exports, and notes on navigation, animal transport, porters, and other commercial matters.

AMERICA.

The Delta of the Mississippi.—Dr. E. L. Corthell read, at the meeting of the British Association at Toronto, a paper on this subject, an abstract of which is given in the *National Geographic Magazine*, December. The delta extends for a distance of 100 miles above the city of New Orleans. The materials of which it is composed have been ascertained by numerous artesian wells, sunk with the object of obtaining potable water. The most remarkable was bored in Lafayette Square, New Orleans, where, after reaching a depth of 1042 feet, the tool was broken; driftwood was pumped up to the last foot.

Many interesting facts were brought to light about two years ago, through investigations connected with a dispute between the executors of the late Mr. James Eads and the War Department. On Belize bayou stands an old Spanish magazine, built over two hundred years ago. In 1877, the building stood perfectly level, with the surface of the water stretching across the arch of the doorway, the sill of which must have been at least ten feet below. Nineteen years later, it was found that the building had steadily sunk at about the same rate as in the preceding two hundred years. This rate, as shown by this and other instances, is about one-twentieth of a foot per annum. And not only are these lands subject to a vertical movement, but they are also unstable in a horizontal direction; a base line 700 feet in length was found after a lapse of five years to measure 712 feet. Bench-marks, level heights and tide-gauges, cannot be maintained with sufficient accuracy for reference purposes. It is a fact well known to people who live in the delta, that large tracts of land were long ago abandoned, owing to the encroachment of the water. And this is due to the sinking of the land, not to the rising of the water of the gulf. Careful investigations all along the coast from Yucatan to Florida disclose no change of level. The difference in precipitation, fluvial discharge, and evaporation is very slight, compared with the great current forces which maintain the Gulf level, the enormous influx through the Yucatan channel.

Prior to the construction of levees, the accretions of sedimentary matter from periodical floods were slightly in excess of the annual subsidence. The benefit, however, to the present generation, accruing from the exclusion of the waters from great areas of the lower delta, will far outweigh the loss to future generations from the subsidence of these lands below the level of the sea, and in the coming century the development of the country, under an efficient system of protection, will doubtless be so remarkable, that the United States can well afford, when the time comes, to build a protective levee against the Gulf waters.

The Ruins of Uxmal.—Dr. Dods, an active member of our Society, has kindly sent the following account of a visit to the ruins of this famous city, the most magnificent, probably, of the ancient Americans.

"From Merida, the capital of Yucatan, the town of Ticul is reached by a narrow-gauge railway, the distance being about forty-eight miles. The country is flat, with rolling hills to the westward. It is covered with dense jungle, about twenty feet high, a few large trees rising at intervals. Maguey, from which the sisal hemp is made, is cultivated in the clearings of the forest. The substratum is a horizontal layer of limestone. Several Indian mounds or pyramids are seen at intervals on the plain. The town of Ticul is scattered over a considerable extent of ground, most of the houses standing in a square plot formed by the intersection of the roads, with a small farm or garden round each. They are built of wattle and mud white-washed, with high pitched roofs, thatched with palm-leaves about two feet thick. The floors are of beaten clay and the doors of wood. Hammocks are used instead of bedsteads. The domestic utensils are mostly of red clay—some of very elegant shape. A calabash gourd is used for carrying water, and the two halves of a round gourd serve for bowls. The town is inhabited by Maya Indians, a remarkably well-formed race, of a light-brown complexion, and wonderfully clean in person and clothing. They usually dress in pure white. The women's garment is always tastefully embroidered in brilliant colours round the neck and on the lower edge of the skirt.

"The road to Uxmal from Ticul is about fifty feet wide in most parts. It is simply a track cut through the forest, no attempt having been made to level it or reduce the inequalities. The limestone rock is continually cropping up above the surface, which makes a ride in a vehicle over the ground anything but comfortable. A carriage called a *volan* is the usual conveyance. It is a sort of box on very high leather springs, with two high wheels, and covered with an arched roof of canvas with curtains of the same material at the sides and ends. A thick mattress covers the floor, and the sides, which are about eighteen inches high, are well padded. Three mules are harnessed to the *volan* abreast, and draw it at a good pace when the road allows of it. The jolting is tremendous, and were it not for the padding on floor and sides, no human being could survive the ride.

"The distance to Uxmal is said to be eight leagues, or twenty-four miles. The ruins stand on a *hacienda* belonging to the Peon family, who have been in possession for over two hundred years. Leaving the *volan* at the *hacienda* building, one has to walk about a mile to the ruins. The first view is very striking. Rising above the jungle are huge mounds and pyramidal structures, crowned with vast buildings and masses of masonry. The first mound reached is called the 'House of the Dwarf,' an artificial structure about one hundred feet high. The sides, which are faced with masonry, are very steep. One side has a huge flight of steps leading to the top, on which stands a large stone building profusely ornamented with sculpture. It contains several rooms, lined with polished stone. On the outside, from about the height of the door to the top of the building, is a mass of elaborate sculpture, each design being made up of several sculptured stones fitted together. Near this pyramid, on an artificial elevation, is another building called the 'House of the Nuns.' It forms a quadrangle, and is in pretty good preservation. It is approached by a gateway with the so-called 'Maya arch,' triangular in form without keystone. The walls are very thick and of solid stone, the mortar being still perfectly white. The inner façade is richly carved. From it open several rooms, in some of which the wooden beam forming the lintel of the doorway is still in position. Near this is the 'House of the Tortoises,' so called from the figures of tortoises above the doorway, and the 'House of the Doves,' with a front consisting of five triangular gables

pierced with holes, which gives it the appearance of a pigeon-house. To the left is the grandest of all the buildings, the so-called 'House of the Governor.' It stands on a tier of three terraces faced with cut stone. The stairways mentioned by Stephens are not now to be seen, being either covered with vegetation or fallen into decay. The ascent is made on rough ladders improvised from trees from the neighbouring jungle. On the topmost terrace stands the palace, with a façade over three hundred feet long and in very good preservation. The sculpture here is most elaborate. There is one very curious ornament, a huge hook of solid stone about two feet in diameter. A row of these runs from the top of the building to the ground in several places. A great number of rooms open on to the terrace. They are all alike—the inside walls of smooth stone, and the ceiling rising in the curious Maya arch to the height of twenty feet. The chambers are usually in pairs, an outer and an inner room connected by a doorway. Looking from this terrace as far as one can see, the mounds and ruined buildings seem to be scattered over several miles, but the density of the jungle renders an examination of them impossible, without a great expenditure of time and labour. The ruins seem to have fallen considerably into decay since Stephens visited them in 1842. Many of the doorways are choked with fallen masonry, and piles of débris lie in all directions half hidden in the dense vegetation. The buildings are massive and imposing, but the sculpture does not show evidence of very high art, and is not to be compared to the beautiful designs at Mitla in Oaxaca. All the names given to the buildings are purely imaginary, as there is absolutely no history attached to these wonderful remains. It is maintained, in some of the old Spanish chronicles, that the Indians were still practising pagan rites at Uxmal at the time of the Spanish conquest."

OCEANIA.

New Zealand.—*The Report of the Department of Lands and Survey* for 1896-97, besides the record of the surveys executed by the Department, contains as usual some narratives of exploration. Mr. Wilmot was sent out to clear up some doubtful points connected with the courses of rivers flowing into Dusky Sound, at the south-west corner of Middle Island. He sketched about 764,000 acres of country between Lake Manapouri (properly Manawa-popore), and Lake Hauroto (properly Hau-roko), and Dusky Sound. The Seaforth river of Mr. Mackenzie is identical with the Mackenzie river, and Loch Maree is only the north-eastern arm of Lake Ida. It is not practicable to make a carriage road from Manapouri to Dusky Sound; a good pass exists between Manapouri and the head of Smith Sound, passing over a saddle 2100 feet high, with fairly easy gradients; and a road might be carried over a good pass between Hauroto Lake and the head of Dusky Sound.

Mr. Brodrick explored a route from Lake Ohau in Canterbury to the Paringa river on the west coast. The route is somewhat difficult, but a foot-track might be made through some interesting country.

Ruapehu and Tongariro have shown unusual activity, and Mr. Lowe thinks it not impossible that the changes going on in the former may result in more violent outbursts.

MISCELLANEOUS.

The meeting of the **British Association** will be held this year at Bristol, commencing on September 7. Sir Wm. Crookes, F.R.S., will be the President.

The *Mouvement Géographique* of Feb. 20 states that a railway is to be made from some point on the navigable part of the Itimbiri eastwards by the valley of the **Welle** to a point in the neighbourhood of Rejaf south of 5° 30′ N. lat.

Mr. John Cook has again sent us his report on the **Meteorology of Mysore**. The new issue contains the tables for 1896. Certain means for 1893-96 are also given. A notable novelty in this publication is a map showing the average annual rainfall for 1870-1896.

M. Foureau has before now expressed doubts as to the hitherto accepted position of the oasis of **In-Salah**, which is based on the itinerary of Gerhard Rohlfs in 1866. A French expedition under M. Flamand has lately made astronomical observations in the Gurara oases to the north of In-Salah, whence M. Foureau calculates the longitude of the latter as 1° 53′ E., that is, considerably east of the old position.

Captain Sand, who in 1895 and 1896 was engaged in the survey of the **Färöe Islands**, states that the position of Thorshaven, the capital, has hitherto been incorrectly given. It lies in lat. 62° 0′ 49″ N. and long. 6° 45′ 23″ W. The loftiest mountain in the group, the Slattaratinde, in the north of Osterö, is 2894 feet high. Stromö has an area of 145 square miles; Naaslö, 3·86; Hestö, 2·3; and Kolter, nearly one.—*Verh. der Gesell. für Erdkunde zu Berlin*, No. 1, 1898.

A short distance from Copenhagen an **amphibious vessel**, as it is styled in *A Travers le Monde*, plies between two lakes over a neck of land 380 yards across. The steamer, named *Svanen* (the Swan), is about 45 feet long by 9 broad, and can carry seventy passsengers. Four wheels are attached to its under part, and on arriving at the shore the vessel is guided by rows of piles to the rails laid across the isthmus. The engineer then disconnects the machinery from the screw and connects it with the front pair of wheels, when the vessel begins to ascend out of the water.

A tunnel has been carried under the **Col di Tenda**, but the masonry will not be completed for another year. 8858 yards in length, it is the fifth in length of the tunnels of Europe. Its highest point is 3405 feet above sea-level. Though constructed chiefly for strategic purposes, the new route will be of commercial importance, for from Mont Cenis to the Col di Cadibona, a distance of nearly 190 miles, there is no railway through the Alps. At present only the section Cuneo-Limone, twenty miles, is finished, and the direction the line will follow on the western side is not yet fixed. The Italian Government would like to carry it through Italian territory, but its continuation over French ground will be cheaper and shorter.—*Geogr. Zeitschrift*, Jahrg. iv., Heft 4.

The **German Deep-Sea Expedition**, proposed by Prof. Chun at the Meeting of Naturalists and Medical men at Brunswick, has been secured by a grant of £15,000 from the Imperial Parliament. The expedition is to sail in August, and begin its investigations on deep-sea organisms between Scotland and the Shetland Isles, then passing southwards by the Canaries and Cape Verd islands to the coast of West Africa, where many problems regarding the deep-sea fauna and plankton await solution, particularly in the cold Benguella current. From the Cape an excursion will be made into the cold Antarctic currents, after the region where these meet with the warm currents from the Indian Ocean has been explored. Then the expedition will return homewards by way of the Indian Ocean and the Red Sea, after an absence of nine months.—*Geographische Zeitschrift*, Jahrg. iv. Heft 2.

Though **gold** is found in paying quantities only in a comparatively few places, chemistry proves that the metal is distributed in minute traces over all the earth's surface. *Himmel und Erde* for March states that it is widely diffused in sea water. Among the forty elements the sea contains, gold and silver occur in

infinitesimal quantities. A ton of water, which would occupy about a cubic mètre (a little more than 35¼ cubic feet), contains 6 milligrammes of gold, and the value of the gold in the oceans of the world may be calculated at some 292 billion pounds sterling. Were this gold collected into one mass, it would form a cube, each side of which would be 2355½ feet. The volume of silver contained in the sea is six times as large, and its value amounts to about 26½ billion pounds. The chalk of southern England contains a very minute proportion of gold, but yet the absolute amount is enough to pay the national debt several times over.

NEW BOOKS.

Through China with a Camera. By John Thomson, F.R.G.S. Westminster: Archibald Constable and Co., 1898. Pp. xiv. p. 284. *Price* 21*s. net.*

Of the many books that have appeared in recent years dealing with China or the Chinese, this one merits special notice because of the beauty of the illustrations. These are all reproduced by a half-tone process from photographs taken by the author, whose skill as a photographic artist is widely known. The veriest tyro in the art will have some idea of the purely technical difficulties Mr. Thomson had to overcome when he learns that all the negatives were taken by the wet collodion process, and that in a land where chemistry is practically unknown. But, in addition to these difficulties, there was at times no little danger attending the photographer as he plied his art among a superstitious and ignorant people. On several occasions he narrowly escaped being mobbed. The book is written in an easy style, following the author's wanderings from Hong-Kong to Canton, Macao, Swatow, Chao-chow-fu, and Amoy, thence to Formosa, and finally back to the mainland. Chapter viii. treats of his experiences at Foochow and on the river Min; in chapter ix. Shanghai, Ningpo, Hankow, and the Yangtse, are dealt with; and the last chapter describes Chefoo, Peking, Tientsin, and the Great Wall. The illustrations, fully eighty in number, are introduced at their appropriate places. They are of all kinds, ethnographical, architectural, scenic-pictorial. One of the most beautiful is a mountain gorge in Formosa; while some of the mountain and river scenes are very impressive. A truly remarkable picture is that of Yuen-fu Monastery, "propped up on the face of a precipice 200 feet in height, and resting above this awful abyss on nothing more durable than a slender-looking framework of wooden beams." In an otherwise perfect picture of a Chinese Pagoda of seven stories there is a curious trace of that imperfect perspective familiar to all workers with the camera—the pagoda seems to bend backwards. It is hardly necessary to go into further detail; suffice it to say that every illustration is a work of art and an education to the eye of some interesting feature of Chinese life or scenery. There is an appendix on the aboriginal dialects of Formosa, giving comparative vocabularies. Considering the great variety of topics touched on, the historic notes, and descriptions of customs, it seems a pity that no attempt has been made to provide the book with an index. This would have added to its value without in any way detracting from its high artistic merits.

Campaigning on the Upper Nile and Niger. By Seymour Vandeleur, D.S.O., Lieutenant, Scots Guards. With an introduction by Sir George T. Goldie, K.C.M.G., D.C.L., LL.D. London: Methuen and Co., 1898. Pp. 301; with maps, illustrations, plans, and appendices. *Price* 10*s.* 6*d.*

"If in the year of grace when Her Majesty was born a traveller had combined

in a single volume his experiences on the Nile and Niger, the incongruity of the subjects would have then appeared almost as great as though the rivers had been the Ganges and St. Lawrence," writes Sir G. T. Goldie in the introduction to Lieutenant Vandeleur's interesting and readable work.

The knowledge of the world, and of Africa more especially, has increased with great rapidity since those days, and now we have men like the late Joseph Thomson, Colonel Lugard, our author, and others, who have lived, worked, and aided the extension of our spheres of influence, north, south, east, and west of the great continent.

There are no doubt many who still question the right of our traders to extend their operations in African wilds; others again object to our Government concerning itself with the slave-trade, and the often most barbarous customs of many African nations. Books such as the one now before us should do much to enlighten those individuals, and to show that, as Sir G. Goldie says, "If Europe had no material interest to protect and develop in Africa, it would still have the same right, the same duty, to extirpate slave-raiding that a man has to knock down a ruffian whom he sees maltreating a woman or child in the street." "The death of each Fulah killed at Bida secured the lives and liberty of scores of peaceful and defenceless natives." One sometimes feels sick at heart that, at the end of the nineteenth century, although our people have progressed in so many ways, public opinion seems to have grown too sentimental, too tender, too weak-kneed, as compared with our forefathers, who spent so much in trying to crush out the slave-trade.

As already indicated, Lieutenant Vandeleur's narrative is divided into two parts; the first deals with his expedition from Mombasa to Uganda, and the overthrow of Kabarega, king of Unyoro; the second treats of the Niger Company's expedition from Lokoja to Kabba, Egbon, and Ilorin, and the defeat of the Fulah in those districts. Both regions dealt with are of present interest, for there are just now troubles in Uganda, and the difficulties between the French and English in the Niger region are equally well known. The author has eliminated the dull record of latitudes and longitudes and of the geographical work from the body of the book, and has given them in an admirable series of maps and three appendices, which is a distinct advantage. The numerous illustrations are exceedingly good.

The account of the equatorial region of Africa is interesting and accurate. The author calls attention to the consequences of the rise of Mahdism, which has caused the Upper Soudan to relapse into savagery, so that where steamers used to regularly run, the only means of communication now is by small boats or dug-outs. Lado was visited and found to be quite deserted. After a considerable amount of fighting, Kabarega was driven from Unyoro, but unfortunately he eluded capture. But as a result of the expeditions in Unyoro the whole country has been pacified, and Kabarega being in exile to the north of the Victoria Nile, that part of the river now forms a perfect frontier. Lieutenant Vandeleur predicts a prosperous future for Uganda after the railway from the coast is completed.

The expedition in the Niger regions is very well described, and the account of the various battles is exceedingly graphic. It is wonderful to read how 500 Hausa troops, led by British officers, withstood for two days between 25,000 and 30,000 of the enemy, and that, although they never before had faced cavalry, yet they stood firm under charges *home* on the faces of their squares, maintained perfect fire discipline, and delivered their volleys as steadily as if on parade. Sir George Goldie thinks that Great Britain has had to rely too much of recent years on Indian troops for tropical climates. The fighting described in this book shows what admirable soldiers can be obtained on the spot, and we are sure that the regi-

ments which are now being raised in the Niger districts will in future do as good work as the men whose prowess is described in this work. One word of warning is necessary. Native troops, whether Soudanese or Hausas, must be judiciously treated; the officers must have sympathy with them and a knowledge of their peculiarities; otherwise difficulties, such as those which have recently been witnessed in Uganda, are bound to result.

We congratulate the author upon his interesting work, and our readers will find its perusal profitable and interesting.

On the Threshold of Central Africa. By François Coillard. Translated from the French, and edited by his niece, Catherine Winkworth Mackintosh. London: Hodder and Stoughton, 1897. Pp. xxxiv + 663. *Price* 15*s*.

In this work Monsieur François Coillard, a missionary of the Société des Missions Evangéliques of Paris, gives an account of two expeditions which he made into Central Africa, for the purpose of spreading the gospel among the heathen. The first, which he calls the Banyai expedition, occupied from about the middle of 1877 to the middle of 1879. In this, leaving British territory at the Leribe mission station, he marched north through the Orange Free State and Transvaal into Banyai, and thence into Matabeleland as far as Masonda's mountain. Thence he turned west to Buluwayo, but having got so far, he was compelled by the dreaded Lobengula to proceed south-west to Shoshong. Here he again turned north, and, crossing the Linyanti river at Lashoma, struck the Zambesi at Sesheke. This was the most northerly point of the so-called Banyai expedition, which, so far as its professed object was concerned—viz., the foundation of a mission station in Banyai—was confessedly a failure. The universal distrust of white men caused by the well-known Langalabelele affair rendered it unsafe for the missionaries to stay in the Matabele country.

The Barotse expedition—the more important of the two—began in January 1884, but instead of proceeding to Matabeleland, Monsieur Coillard, who was accompanied by his wife and niece, marched north-west from Pretoria into Khama's country, and thence due north to Leshoma on the Linyanti. For three years the party worked at Leshoma and Sesheke. Its headquarters were transferred early in 1887 to Sefula, a place near Lealuiya, the capital of Barotse land, and in 1892 the mission succeeded in planting a station in Lealuiya itself. In 1893 a fifth station was opened at Kazangula. In 1896 Monsieur Coillard's health broke down, and he had to return to Europe. His wife had died at Sefula in 1891.

Exploration was of course not one of the objects of Monsieur Coillard and his comrades, and the records of his expeditions disclose no new matter in that respect. But he is in his own line a keen observer, and his experiences with the Matabele and Barotse throw a lurid light on the habits and customs of these ferocious tribes, and show us that the descriptions given by other travellers are in no way exaggerated. Of them it may be said with absolute truth, that morals they have none, and their manners are beastly. If we accept Monsieur Coillard's account of them—and he writes in the truly charitable spirit of a missionary—they are sunk in the lowest degradation of fetichism, and indulge freely and shamelessly in every vice; they have no respect for life, and their greatest pleasure is in revolting cruelty. It argues no small personal courage and a very profound and sincere faith in their calling on the part of these missionaries—more especially the ladies of the party—to have faced the dangers and endured the hardships of all these years. Monsieur Coillard remarks: "Among the lukewarm friends of missions, I have sometimes heard the remark that missionaries' letters are generally sunshiny pictures without

shadows." If there be any such among our readers, a perusal of this volume cannot fail to be a good corrective. His often sad, but always interesting, story is written in simple, unexaggerated language, with no attempt at effect or fine writing. We close the book with a feeling of profound respect for the author, and a sincere admiration for the courage, energy, and tact he displayed on many critical occasions, and for the patient perseverance and gentleness which he and his comrades habitually showed under trying circumstances, where most people would have given up their task as hopeless. The illustrations and maps are excellent.

The Niger Sources and the Borders of the New Sierra Leone Protectorate. By Lieut.-Col. J. K. Trotter, R.A. London: Methuen and Co., 1898. Pp. 227. Two Appendices, four Illustrations, and Map. *Price* 5*s*.

This book is published at an opportune moment, for our thoughts are turned to West Africa, where France and Britain are in some real danger of conflict. France has been for years following a settled policy of extension in Africa, and now we are obliged to face an awkward situation which, had we had a settled policy, would never have occurred. This is only another instance of the need of geographical societies and of the great importance of educating the people in commercial geography, to which such great attention is paid by our continental rivals.

Our author was assisted by Captain Tyler, R.E., a member of the joint-commission to mark out the boundary between the French and British spheres of influence agreed upon between the two nations on January 21, 1895.

The map well illustrates the result; it is drawn to the scale of 6·3 miles to the inch, and the latitudes of 36 points of importance are given.

On his journey to Freetown, Colonel Trotter notes the "special provision of Providence that the Canary group and Madeira, probably the finest health resorts in the world, lie so close to the deadly West African coast, and are all so easily accessible to invalids from Gambia, Sierra Leone, etc."

At Sierra Leone, he points out that the health of the place could be much improved by modern sanitary science and by more social recreation; and that the leading shop in Freetown is that of a French company—many British companies having failed to do paying trade!

It is certainly remarkable that these things should be. We permit free trade: other nations close their markets against us, with the result that we are marching backward with monotonous regularity. It is quite time this state of things were ended. Colonel Trotter also points out that Freetown is the only good harbour in West Africa, eight days' steaming at thirteen knots from Southampton, and about the same distance from the Cape. It ought to be the great coaling station for the North Atlantic, and yet vessels are sent 200 or 300 miles out of their course to coal at St. Vincent, "anchoring in an exposed roadstead, off a barren coast where the coaling arrangements are of the worst, and where no fresh provisions are to be had."

To turn to the expedition: with the exception of Mr. Parkes, the superintendent of native affairs, the Sierra Leone people are not interested in questions of the interior, but he organised the transport and supply for the expedition, which consisted of the two Commissioners, Captain M'Kee, Dr. Paris, four sappers of the Royal Engineers, and 448 native porters. The French Commissioners were Captains Passarge, Cayrade, and Millot, with ten Senegalese soldiers and ninety-two porters. The joint-commission started on December 16, 1895, and arrived at Massama, their work accomplished, on May 5, 1896.

There is a great deal of valuable information in this book. Our author writes with great common-sense on the health question, noting that at altitudes "from

1500 to 3000 feet above sea-level, the air is perceptibly much fresher, the capacity for work is undoubtedly greater, and the night temperature as recorded by the thermometer is, in the dry season at least, much lower than in the low country. If a man lives well, and takes proper precautions, he should do well." "In such a climate, to rough it is to court fever," but the transport is the difficulty in providing good food; railways must be made. The whole country is covered with high, dense vegetation, except only on the top of the spurs of the Tamisso mountains. In the northern part of the protectorate the altitude above sea-level varies from "800 feet as a maximum, just north of Bumban, to 3300 feet near Tembi Kunda, the summits of the highest mountains being about 5000 feet." There is little or no indication of mineral wealth. The inhabitants are well described. The book can be warmly commended. The four photographs are very good, and the map is excellent.

Exploration and Hunting in Central Africa, 1895-6. By Captain A. St. H. Gibbons. London: Methuen and Co., 1898. Pp. 408. *Price* 15*s*.

The greater part of this book is devoted to descriptions of hunting expeditions in the kingdom of Marotse; but Captain Gibbons, in addition to interesting and now and then exciting descriptions of hunting, provides for his readers much valuable information, which may be taken as supplementary to the descriptions of the people and country of the Barotse supplied by the French missionary Monsieur Coillard, which we notice this month. The venerable missionary's experience lay mostly in the low swampy grounds of the Zambesi and its tributaries. Captain Gibbons, however, penetrated into the uplands, where the missionaries have not yet effected a settlement, and with regard to them his information is new and valuable. He has also filled up the gap in the history of that part of Africa by setting forth the events which brought about the fall of the Makololo and the rise of the present Marotse dynasty. The reigning King Lewaneka rules a territory somewhat larger than the German Empire, and although not so civilised as Khama, still for an African despot he is in many respects better than we could expect. Those who read Monsieur Coillard's work will know who planted and watered the seeds of civilisation and reform, and it is pleasant to find Captain Gibbons cordially acknowledging the good work done in many ways by the missionaries. We have also an excellent but very brief account of the general characteristics and customs of the tribes who inhabit the south of Lewaneka's kingdom. Writing of Matokaland, Captain Gibbons says: "The country here is destined to be a favourite spot for white settlement. High and undulating, good soil and grass, semi-open, well-watered. Trees picturesque, the predominant one bearing a drooping leaf something like syringa; others at a short distance looking like chestnut, beech, lime, and ash. There are many ant-heaps forming mounds some ten to fifteen feet high which are almost invariably covered with trees. The healthy nature of this plateau seems to leave nothing to be desired. Convalescent as I was at the time from the worst and most weakening of African diseases (viz. dysentery), I rapidly regained vigour. . . . Drought in Matabeleland does not necessarily mean drought in the Marotse empire—a better watered country and inhabited by a more industrious people. In March 1896 I left behind a gathered harvest capable of keeping Lewaneka's people for two or three years." Like all Englishmen who write on Central Africa, Captain Gibbons waxes eloquent in his denunciations of the ferocious Matabele, and probably the most stirring passage in the book is a gruesome description of the horrors of a Matabele raid. The illustrations are good, and there is a very useful map and index.

From the Tropics to the North Sea. By Fanny A. Barkly. Westminster: The Roxburghe Press, n.d. Pp. 252. *Price* 3*s.* 6*d.*

In this volume Mrs. Barkly, the widow of the late Mr. A. C. S. Barkly, gives us some sketches of her life and experiences at the Seychelle Islands in the Tropics, and at Heligoland in the North Sea. Life in the former place seems pleasant and attractive, although tempered by mosquitoes and a variety of "creeping creatures," whose attentions are anything but agreeable. Here, for example, is her account of what happens after a visit to the swimming bath at Government House: "The only drawback to this perfect bath was, that it was the favourite resort of centipedes, scorpions, and the harmless but very unpleasant millepattes, with their long black bodies and thousand legs. The centipedes were our worst enemies: they looked horribly wicked, and used to make a rush for us while dressing after the bath, and one had always to be provided with some sort of a weapon, as they would run and attack one in the boldest manner." Domestic servants also seem to be somewhat of a trial to their mistresses. The men get drunk, and the women *borrow* their mistresses' gloves, stockings, fans, etc. Writing of her maid Françoise, Mrs. Barkly says: "I saw her one day, coming back from church, arrayed in a pink tarlatan dress with ribbons, black velvet bodice, cut square in front, with white tulle, pearl and gold comb in her woolly hair, and pearl earrings. She used to run out and climb to the top of a high rock like a monkey, to comb out her much frizzled black wool. This beautiful toilet was completed by a fan, a long pair of *gants de Suède* belonging to me, and very high-heeled French boots." When she was remonstrated with for adopting so startling a toilet, she remarked to another maid, "Pauvre madame! elle est jalouse, elle n'a pas de toilettes comme ça." Mrs. Barkly gives us incidentally a good deal of information regarding the products of the Seychelles, *e.g.*, the coco-de-mer or double cocoanut, bananas, preserves of all kinds, vanilla, spices of various sorts, and tobacco, and she had the good fortune to see a real ghost on one of the islands.

Mrs. Barkly's husband was the last British Governor of Heligoland, going there in 1888, and making over the islands to the Emperor of Germany in 1890. The larger of the two islands has a circumference of only three miles, and owing to the action of the sea, is becoming smaller and smaller every year, so that in course of time there is every chance of it disappearing altogether. Under the English régime it was a popular place of resort for summer visitors from Germany, and apparently there was nothing to do except to bathe, promenade, and dance. "The climate is perfect as a health resort, perhaps rather too cold in winter for real comfort, but most bracing and exhilarating." Crime was practically unknown. Mrs. Barkly mentions, "I only remember seeing one prisoner; and he, on being condemned to imprisonment for some offence, walked quietly off to the little prison, rang the bell, and let himself into 'durance vile.' This sounds almost Arcadian in its simplicity, but is nevertheless a fact, and reminds one of the opera of the 'Mikado.'" Equally Arcadian, if less convenient, were the proceedings of the summer visitors. "They flocked to the island from all parts of the world; sometimes they used to march straight into Government House, thinking it was an hotel, and demand rooms there, and were quite affronted at being told that it was the residence of the Governor and his family. One man said, 'Never mind, it will do; we will come at once.' We used to have an immense number of visitors of all kinds, from the highest to the lower middle classes. Very often they would arrive at 9 A.M. and walk into the kitchen, even omitting to ring the bell. We used to encounter large parties strolling leisurely about the house, apparently feeling very much at home there."

But with the change of Government a new régime has fallen upon Heligoland, and it has now become simply a German fortress in which everything is subordinated to military considerations. The present generation only is exempt from the conscription, and local laws and customs are to remain unaltered only *as far as possible*; so the Arcadian simplicity of Heligoland is bound to disappear unless the millennium commences, or what is more likely, the North Sea disintegrates and overwhelms the islands.

Mrs. Barkly has an eye for the beauties of nature, a facile pen, and an easy, agreeable style. Her little book may be commended as a pleasant sketch of two comparatively unknown or little-thought-of places at opposite ends of the world.

Nach Ecuador. Reisebilder von P. Joseph Kolberg, S.J. Vierte, ergänzte Auflage. Mit einem Titelbild in Farbendruck, 150 Illustrationen im Text und zwei Karten. Freiburg im Breisgau: Herdersche Verlagshandlung, 1897. Pp. 535+xvi. *Price* 9 *M.*

Although the journey of which Father Kolberg gave an account in *Nach Ecuador* was made as far back as 1871, the description of the hardships of travelling in the Republic of Ecuador and the general state of the country apply with almost equal force to the present day, as is pointed out by the editor of the fourth edition, who undertook to bring Kolberg's book up to date after the author's death. We can easily understand that a book of this kind should have passed through four editions. Kolberg's narrative of his journey cannot help charming the reader, but over and above, he has contrived to give his account a great educational value by the fascinating manner in which he explains the natural phenomena that came under his notice in his journey and during his sojourn at Quito. We would point especially to his description of volcanic action in Ecuador, and the theories it suggested to him of mountain origin, volcanoes and earthquakes. For the vague idea of lateral pressure, which is by many held sufficient to account for the birth of mountain ranges, our author substituted more exact reasoning based on strictly mechanical laws; and it seems to us that the Appendix, which contains a complete exposition of his theories, deserves more attention from geologists than it appears to have received. An English translation of this Appendix would, we believe, be welcome to geologists in this country.

The Rivers of Great Britain, Descriptive, Historical, Pictorial. Rivers of the South and West Coast. London: Cassell and Co., 1897. Pp. 376. *Price* £2, 2*s.*

The Thames and the rivers of the east coast having already been described in this sumptuous series, this beautiful volume describes those of the south and west coast. Exquisite views from photographs, and a fine etching by Wm. Bradley, adorn its pages, whilst sketch-maps of each river basin are given. The letterpress is admirable: Mr. Wm. Senior describing the southern chalk streams and the rivers of Lancashire and Lakeland; Mr. W. W. Hutchings the rivers of Devon; Mr. Hugh W. Strong those of Cornwall and the Parret and Lower Avon; Professor Bonney the Severn; Mr. E. W. Sabel the Wye and Usk; Mr. Chas. Edwardes the rivers of South Wales; Mr. Aaron Watson those of North Wales; Mr. W. S. Cameron the Mersey; Mr. Francis Watt the rivers of the Solway Firth; and Mr. John Geddie those of Ayrshire and the Clyde. Reprinted in a cheap form with the maps, but without expensive illustrations, the volume would be of much educational value.

Natalia: A Condensed History of the Exploration and Colonisation of Natal and Zululand from the Earliest Times to the Present Day. By J. Forsyth Ingram, author of *The Land of Gold, Diamonds, and Ivory*, etc. London: Horace Marshall and Son, n.d.

In this volume the text and illustrations occupy nearly equal parts, and are, perhaps, of nearly equal importance. The sketch of the history of Natal is necessarily somewhat slight, though it contains references to all the events of importance. Many useful statistical and other data are contained in the third chapter, which deals with "Natal of the Present." The effect of the completion of the line to Johannesburg is strikingly shown by the increase of imports and exports.

The second part of the book consists entirely of photographs, illustrating the towns, scenery, occupations, and natives of the country. Some of them are very good reproductions.

Studies in Indiana Geography. (First Series.) Edited by Charles Redway Dryer, M.A., M.D., Professor of Geography in the Indiana State Normal School. Terre Haute, Ind.: The Inland Publishing Company, 1897. Pp. 113. *Price* $1.25.

We welcome this small quarto volume on the geography of Indiana, not merely as a contribution to our knowledge of a region hitherto undescribed by scientific geographers, but also as a sample of the good work being done by the young American school of geographers.

Most of us probably know little more about the State of Indiana than that it lies between Lake Michigan and the Ohio river, that it is mainly prairie, except in the south-east, and covers an area nearly $1\frac{1}{4}$ times that of Scotland. It is something to have a systematic study of such a vast region, embodying the gist of the elaborate and uncoordinated memoirs of the different surveys, as well as an outline of the results of recent investigations hitherto unpublished. Six chapters in the book describe various phases of its physical geography, one deals with the city of Terre Haute, and one discusses the history of the Great Lakes.

The opening chapter is on the New Geography, which means Evolutionary Geography. The editor notes how the use of the evolutionary ideas has revolutionised Physical Geography, but omits to point out the equally, if not even greater, changes brought about by the same process in Biological and Social Geography.

We should like to see similar works attempted for Scotland. This Society might well turn its attention to the matter, and secure the preparation and publication of monographs of the various natural regions, which would deal with the human as well as the physical geography, and form a new statistical summary, giving an account of Scotland at the beginning of the twentieth century.

As Colonias Portuguezas. Geographia Physica, Politica, e Economica. Por Ernesto J. de C. e Vasconellos, Capitão Tenente da Armada, Hydrographo, etc. Lisboa: Typographia da Companhia Nacional Editora, 1896. Pp. 441.

There is no room to doubt that this is a useful handbook of the Portuguese colonies, and it has been brought up to a very recent date, having evidently been published in 1897, though 1896 appears on the title-page. The statistical

information is full, and the latest explorations have been made use of in the physical descriptions. A little more light on the future prospects of the colonies, and of particular cultivations and occupations, would have been useful, both for the solution of diplomatic and economical questions, to which the author refers in his preface, and for the guidance of emigrants and commercial men. For instance, the decline in Goa of the cultivation of rice is ascribed to the convention with Great Britain, rice being grown under more favourable conditions in British territory. The convention was said to have greatly increased the prosperity of Goa, and it may be that the cultivators of rice turned their attention to some more profitable occupation. At any rate, as the convention was abrogated in 1892, it seems rather late to *suppose* that the rice cultivation will revive.

It seems singular that the heights of mountains in the Cape Verde Islands should still be so uncertain. For the peak of Fogo the author gives 3220 mètres, and Professor de Mello, in his *Geographia Geral*, 2980. Again, we have here 1485 mètres as the height of the peak of Antonia, while Professor de Mello gives 2260, and M. Reclus 1800. In the former case Senhor Vasconellos cites a good authority —Felix de Brito Capello.

Notions générales sur l'Écorce terrestre. Par A. DE LAPPARENT, Membre de l'Institut, Professeur à l'École libre de Hautes Études. Paris: Masson et Cie., N.D. Preface dated September 1897. Pp. 156.

This little book contains six University Extension Lectures delivered to an audience of young ladies at the *Institut Catholique* in Paris, in 1897. It gives in very clear and readable way an account of current ideas about the earth's crust, and may be regarded as a popular summary of the doctrines enunciated in the author's admirable *Leçons de géographie physique*, which was reviewed in this Magazine in vol. xiii., p. 53. It may be especially commended to teachers of Physiography. In one or two places the statements are too absolute; for instance, about the length of the night at the Equator, on p. 36.

The Statesman's Year-Book. Statistical and Historical Annual of the States of the World for the Year 1898. Edited by J. SCOTT KELTIE, LL.D., Secretary to the Royal Geographical Society, etc., with the assistance of I. P. A. RENWICK, M.A., LL.B. London: Macmillan & Co., 1898. Pp. xxx + 1166.

The principal feature in this year's issue is a series of maps illustrative of British trade throughout the world, and a set of diagrams exhibiting the variations of the commerce of nations during the past twenty-five years. A map of the Niger region is very welcome at the present moment. The navies of the world, which have been carefully revised, will be found, as usual, under the countries to which they belong. It is well to point this out, as, by an oversight, they are referred in the index to p. xxxiii.

Brown's Comprehensive Nautical Almanac, Harbour and Dock Guide and Advertiser, and Daily Tide Tables for 1898. Glasgow: James Brown and Son. Pp. 292. *Price* 1*s.*

The above *Almanac*, earlier issues of which have been noticed in the *Magazine*, contains in a handy and condensed form all the information, especially for the seas of the United Kingdom—co-ordinates of stars, lunar distances, lists of lights, etc. Various miscellaneous information is also added.

NEW MAPS.

EUROPE.

GEOLOGICAL MAP OF ENGLAND AND WALES. Reduced chiefly from the Ordnance and Geological Surveys, under the direction of Sir ARCHIBALD GEIKIE, D.Sc., F.R.S., Director-General of the Geological Survey. Topography by JOHN BARTHOLOMEW, F.R.G.S. Reduction from Geological Survey's Maps made by F. BOSSE. Scale 10 miles to an inch. Edinburgh Geographical Institute: John Bartholomew and Co., 1897. *Price* 12*s.* 6*d.* on cloth.

Until this more perfect map appeared, the leading geological map of England and Wales was that of the late Sir A. C. Ramsay, Director-General of the Geological Survey, a map on the scale of twelve miles to the inch, the first edition of which was published in 1859. Various editions of Ramsay's map have been issued, but, its topography being based on the old Ordnance Survey, it is not now possible to bring it thoroughly up to date. Its price was 42*s.* on cloth, or 29*s.* 6*d.* more than the map under notice. On a comparison of the third edition (Stanford, 1866) of Ramsay's map with the present one, we observe that the former is strictly limited to England and Wales, whereas the map under notice embraces the geology of South-West Scotland and parts of the Irish and French coasts. Besides, the geological details of the present map are much more elaborate than those of Ramsay's, as may be judged by the fact that in Ramsay's map the separately coloured igneous rocks are only three in number and the sedimentary rocks are only twenty-eight, whereas in the map under review the igneous rocks coloured variously number six and the sedimentary rocks forty-four.

The present makes an excellent travelling map, as well as a geological one. Sir Archibald Geikie has prefixed to it "Explanatory Notes" describing the various rock systems. These notes, he says, "are intended merely for the general reader or traveller who may have no special geological knowledge, but may be induced to take the map with him as a convenient guide in journeying across the country"; adding, "The traveller or tourist who journeys with a geological map in his hand can mark how each distinct change in topography arises from a corresponding alteration in the character of the geology. The variations of scenery consequently acquire for him a new meaning and interest. There is no part of Europe where the relation here described can be better seen than in England. Even from a rapid railway journey much may be learnt here regarding the dependence of topography upon geological structure."

ASIA.

LOMBOK, Kaart van het Eiland ——, Schaal 1 : 200,000. Vluchtig opgenomen van November 1895 tot Juli 1896.

SOEMBA, Kaart van het Eiland ——, Schaal 1 : 500,000. Januari 1897.

BALI, Kaart van het Eiland ——, Schaal 1 : 250,000. April 1897.

NEDERLANDSCH NIEUW-GUINEA, Kaart van ——, en omliggende Eilanden. Schaal 1 : 2,000,000. Januari 1897.

The above maps, issued by the Topographical Bureau in Batavia, reproduce the latest results of survey and explorations. For the maps of New Guinea and the adjacent islands and of Soemba the narratives of De Clercq, Planten, Baron von Hoëvell, Ten Kate and others, published in the *Tijdschrift van het Kon. Nederl. Aardrijkskundig Genootschap*, have been consulted; while for the topography of Bali and Lombok the general staff and the naval hydrographers are responsible.

The execution is clear and sharp as a rule. Only in the map of Lombok is there some indistinctness, due to an attempt to represent too much on one map.

THE SCOTTISH
GEOGRAPHICAL
MAGAZINE.

THE TUNDRAS AND STEPPES OF PREHISTORIC EUROPE.[1]

By Professor James Geikie, D.C.L., LL.D., F.R.S.

I.

We are all familiar with the general conclusion arrived at by geologists that our earth has experienced many climatic changes. There have been times when genial conditions ranged up to the highest latitudes, and times also when the cold of the Arctic regions descended to what is now our temperate zone. The cause or causes of those remarkable vicissitudes still baffle research. Many explanations have been advanced—some highly improbable, others perhaps more likely, while of yet others it may be said that possibly they contain a certain amount of truth. But no one theory or hypothesis has succeeded in gaining general assent, and we shall not therefore at present concern ourselves with any. In place of reviewing hypotheses and speculations, I shall limit myself to a survey of certain facts connected with the later geological history of our continent, the meaning of which is more or less apparent. The evidence referred to leads to the conclusion that Middle Europe has within the human period experienced conditions such as now obtain in the tundras and barren grounds of circumpolar regions. When these conditions passed away, the Central and West-Central areas of our continent became steppe lands, comparable as regards climate to the sub-arctic steppes of south-east Russia and south-west Siberia.

As geologists reason from the present to the past, it will be well to take first a brief glance at those regions of the globe where at present

[1] A Lecture delivered before the Royal Dublin Society, 9th March 1898. Those interested in the subject of this lecture will find it fully discussed by Professor Nehring in his work *Ueber Tundren und Steppen*. See also, for further information and for references to other authorities, *The Great Ice Age*, chapter xxxviii.

tundra and steppe conditions respectively prevail. When we have realised the salient characters of those regions, and the nature of their floras and faunas, we shall be in a better position to understand the bearing of the geological evidence.

The Arctic lands of Eurasia and North America show two well-marked zones—a zone of treeless wastes bordering the Polar Sea, and a coniferous forest zone lying immediately to the south. The treeless wastes are known as tundras in Europe and Asia, and as barren grounds in North America. These form plains of immense extent, but of very unequal width from north to south. In Eurasia they lie for the most part north of the Arctic Circle, while in North America they range upon the whole considerably farther south, reaching the 60th parallel on the western shores of Hudson Bay. Their southern boundary, however, is in both Old and New Worlds exceedingly irregular. Where the flat lands are exposed to the full sweep of the northern blasts, tundra conditions advance far to the south, invading the forest-zone in narrower or broader stretches. Indeed, even within the region of Arctic forests isolated patches and wider areas of tundra are encountered. In other places more sheltered from the fierce winds coming from the Polar Seas, the Arctic forests in their turn encroach upon the tundras, so as nearly to reach the shores of the frozen ocean. Such is the case in the valleys of the Yenesei, the Khatanga, the Olenek, the Lena, and other North Siberian rivers. Similarly in North America the Arctic forests straggle down the valleys of the Mackenzie and other rivers to beyond the Arctic Circle.

Mosses and lichens form the prevailing vegetation of the tundras—marshes and bogs extending over vast areas in spring and summer, while the less marshy tracts are carpeted with grey lichens. Here and there, too, in sheltered spots, dwarf birch and willow-scrub sprinkle the surface or flourish in denser masses, and ever and anon more or less wide stretches of meadow put in an appearance. Now and again the interminable plains give place to rolling ground, the low hills and knolls being not infrequently clothed with dwarf trees. No hard and fast line, indeed, can be drawn between the tundras and the Arctic forests. The two regions not only interosculate, but numerous oases of trees are encountered in the tundras along their southern margin, while equally numerous patches of tundra, as already mentioned, are met with farther south within the Arctic zone. It may be added, that in Northern Siberia bare rocky hills and mountains—highly fissured, and showing many gullies, ravines, and *débris*-strewn valleys—now and again break the uniformity of a tundra landscape.

A word or two now as to the characteristic animals of the tundras and barren grounds. First among these come the arctic lemmings. They feed on grass-roots and stalks, mosses, reindeer-lichens, and the shoots of the dwarf birch, for which in winter they tunnel through the turf or under the snow. The banded lemming is an especially characteristic form, since it is confined to the maritime tracts of Eurasia and the adjacent islands, and the corresponding areas of North America, and is never met with in the forest-zone. The Obi lemming has a similar

distribution, but ranges somewhat farther south, and not quite so far north, as the banded lemming. The arctic fox is another characteristic member of the tundra fauna, having a high northern range. It occasionally wanders south to the 60th parallel, but that is only in treeless regions, for it everywhere avoids the forests, seeming to prefer the barest and most sterile lands. Another common denizen of the tundras is the arctic or mountain hare. This is the same species so commonly met with above the limits of the forests in the mountains of temperate Europe. A closely allied form (polar hare) frequents the barrens of North America. The reindeer must also be included in the tundra fauna, although in winter it ranges far into the forest-zone. The musk-ox, formerly a native of Eurasia, is now confined to North America. Like the arctic fox it avoids the forests, ranging north of these from the 60th parallel up to the highest latitudes.

Such are the most characteristic mammals of the tundras. There are many other animals, however, which frequent the same regions, more especially in summer. Among these may be mentioned glutton, voles, ermine, weasel, wolf, common fox, and brown bear. The summer visitors also include a vast host of birds, especially water-birds.

The climate of all these northern plains is extreme—the winter temperature falling upon an average to 27° below zero, while in summer the average temperature is about 50° F. The actual range in certain regions is of course considerably greater. These conditions necessarily give rise to annual migrations. Only a few mammals, as we have seen, brave the long winter of the tundras—where river and lake are often frozen solid, and the whole land is sheeted in snow. During the great frosts the air is remarkably still, but as winter draws to a close, storms of wind and snow become frequent. Wide regions are then often swept bare, and the snow is blown into every abrupt hollow and depression in the plains, and into the gullies and ravines of the hills, where it becomes so beaten as often to bear the weight of a man. Not only snow, but sand and dust, are thus swept forward. The sand and dust are no doubt largely obtained from the great river valleys and deltas, but no inconsiderable proportion is derived also from the bare rocky hills and mountains, which in many places diversify the surface of the circumpolar plains. Frost is a great pulveriser of rocks, not only splitting them into fragments, but disintegrating their surfaces into grit, sand, and dust. It is remarkable how in the highest northern regions the surface of the snow often becomes discoloured with fine sand and dust derived in this way from exposed rock-surfaces.

We need not enter into further details as to the physical conditions of the tundras. It will be sufficient to sum up here the points which are most deserving of our attention. Briefly they are these:—

1. The climatic conditions of the tundras are extreme, and necessitate annual migrations.

2. The flora is represented chiefly by mosses and lichens. Here and there, however, tracts of grassy meadow occur, while inlets and oases of dwarf trees and scrub, chiefly birch, willow, juniper, and conifers, not infrequently appear along the southern margin of the tundras.

3. The most characteristic animal forms are lemmings, arctic fox, arctic hare, musk-ox, and reindeer. Of common occurrence also are various voles, ermine, and weasel. Their range, however, is hardly so far north, and they go much farther south. So again the wolf, the ubiquitous common fox, and the brown bear, are frequent visitants rather than constant denizens of the tundras.

4. In summer many of the animals just named push farther north, while swarms of birds (especially water-birds) visit every part of the treeless zone.

5. Lastly, in winter, storms of snow and dust are common.

We may now take a similar brief glance at the steppe lands of Europe and Asia. The regions included under this head show considerable variety. Some steppes are mere desert wastes, while others are fertile tracts capable of high cultivation. Many are low plains, others are elevated plateaus—the former having a sub-arctic, the latter a sub-tropical climate; and between low and high steppes many gradations are met with. All are more or less characterised by an extreme range of temperature. The steppes with which we are at present concerned, however, are the generally low grassy plains which Professor Nehring designates the sub-arctic steppes. These occupy wide areas in south-east Russia and south-west Siberia, extending between the middle course of the Volga and that of the Irtysch. It is quite a mistake to suppose that these steppes are throughout all their extent treeless plains. In many places chains and irregular groups of hills diversify the surface, while here and there trees of various kinds, such as pines, larches, birches, oaks, limes, alders, willows, wild-apples, and others, are more or less plentiful. Many of the woods are mere oases, extending along the banks of rivers and streams, or clustering round the margins of freshwater lakes. In south-east Russia the boundary between the steppes and the forest lands is very irregular—the two regions constantly interosculate.

The climate of these sub-arctic steppes is quite continental—the summer being relatively warm, and the winter relatively cold. The average temperature in January hardly exceeds 3° F., while that of July is at least 70°. Again, the rainfall is very uncertain. In some years it is excessive, in others meagre, while occasionally it altogether fails. With the approach of spring vegetation rapidly develops, becoming rank and luxuriant, but with the heat of summer it quickly fades and withers away. Severe frost, and frequently heavy snowstorms, characterise the winter. In such areas as are more or less wooded, the climate is somewhat less continental—the summers being relatively less dry, and the winters not so cold. But even in those wooded regions the seasons are strongly contrasted. In general, we may say, the steppe-lands in summer are practically rainless. The ground is thus parched and burnt up, so that sand and dust rise with every wind: and as the open plains are often swept by summer búrans, vast quantities of loose materials are transported from place to place, and here and there accumulate in hollows and depressions, or come to rest in the lee of sheltering rocks and hills. In winter, if little snow has fallen, the unprotected

ground is similarly scoured by the tempests—dust, sand, and even small stones being carried forward. Thus both in summer and winter sand and dust storms play an important *rôle*, and loose materials are piled up to great depths in valleys, and in the ravines, fissures, and crevices of the rocky hills.

As a rule these heaps and sheets of drifted sand and dust show little or no arrangement, although now and again some trace of bedding may appear. Should they chance to become well covered with snow in winter, then, when warmth returns and the snow gradually melts away, plants quickly spring up, and the heaps become fixed and cease to drift. It is obvious that not infrequently land-shells, and often enough the remains of mammals, must be entombed in such wind-blown materials.

In winter, however, it is snow more commonly than dust that drifts before the wind. The great snowstorms of the sub-arctic steppes are quite as terrible as those of the tundras. No life can withstand the fury of the blizzards, and many are the disasters on record. Thus in 1827 all the flocks and herds that wandered over the steppes between the Volga and the Urals perished in one great storm. According to the Government Report the loss sustained by the Kirghiz amounted to 10,500 camels, 280,500 horses, 30,480 cattle, and 1,012,000 sheep. Not many years pass without some disaster of this kind, and when the snow has melted away, hundreds of cattle, often far strayed, may be found huddled together in one place—some suffocated, frozen, or starved to death, others drowned in the creeks and ravines in which they had vainly sought for refuge from the blast. Now we can readily conceive how the carcasses might eventually be buried under drifted sand and dust, and the bony skeletons thus become preserved for an indefinite period.

Among the most characteristic animals of the sub-arctic steppes are jerboas, pouched marmots, bobac, pika or tailless hare, small hamster rat, various voles, corsac, caragan fox, manul cat, saiga, dzeggetai, wild horse, etc. Besides these, many other animals are met with in the steppes, but are hardly so characteristic, since they range into adjacent regions, to which they more properly belong. Amongst them may be mentioned lynx, wild cats, tiger, wolf, jackal, common fox, martens, ermine, weasel, otter, glutton, badger, brown bear, squirrels, beaver, common hare, mountain hare, wild boar, elk, reindeer, roedeer, stag, etc. Several hundred species of birds frequent the steppes, among which may be mentioned great and little bustards, larks, grouse, buzzards, eagles, owls, etc.

We may now sum up, in a few words, those features and characters of the sub-arctic steppes which are of most importance from our present point of view.

1. Steppes, like tundras, are not exclusively plains. They include rocky uplands and hills, and are traversed in many places by streams and rivers.

2. Vast expanses are clothed with grasses, while others are more or less sterile and bare. Oases of forests are not infrequently present.

3. The most characteristic animals are jerboas, pouched marmots,

bobacs, and others—the mammalian fauna being more varied than that of the tundras.

4. Many animals properly belonging to forest-lands and to mountains frequent the steppes.

5. The seasons are strongly contrasted, and the whole region is exposed to dust-storms in summer, and to snowstorms in winter.

With these facts relating to existing tundras and steppes kept in view, let us now examine the evidence adduced by geologists to show that tundra and steppe conditions have successively prevailed in Middle Europe.

One of the most remarkable superficial deposits of Central and West-Central Europe is that which is known under the general term of löss. Typically it is a fine-grained, yellowish, calcareous, sandy loam—consisting very largely of minute grains of quartz, with some admixture of argillaceous and calcareous matter. Upon the whole the quartz-grains are well rounded, although often enough they are sharply angular. Frequently the accumulation shows a porous structure, and is penetrated by long, approximately vertical root-like tubes or canals, lined with calcareous matter, which cause the deposit to cleave or divide in vertical planes. Hence it usually forms more or less upright bluffs upon the margins of streams or rivers which intersect it. It is usually unstratified, except now and again towards the bottom of the deposit, where intercalated layers, and even sometimes thick beds of sand, make their appearance. The löss is essentially a deposit of the low grounds, and is well developed in the broad river valleys of Western and Central Europe, as in those of the Seine, the Garonne, the Rhone, the Maas, the Moselle, the Rhine and its tributaries, the Danube and many of its affluents, such as the Drave, the Save, the Morava, and the Theiss. It also extends as a narrow belt along the southern margin of the great plains of North Germany. It is in southern and south-eastern Russia, however, where it attains its widest development, covering as it does an immense tract, stretching west and east between the valleys of the Pruth and the Volga. Throughout this vast region it is usually very dark in colour, forming what is known as the Black Earth.

Without at present going into the question as to the origin of the materials of which the löss is composed, it is obvious enough that they have in some places been arranged by water. Thus here and there, especially at or towards the bottom of the accumulation, distinct traces of bedding may be seen, and the beds have yielded freshwater shells. This, however, is exceptional. Löss is, for the most part, a sub-aërial accumulation—a wind-blown deposit. This is shown not only by the rounded character of its minute constituents and by the general absence of bedded arrangement, but by the abundant presence of snail-shells and the frequent occurrence of relics of land animals. Its organic remains are essentially terrestrial. Moreover, its particular distribution—the mode in which it occurs—points clearly to the action of prevalent winds. Thus, although it is widely developed over low-lying regions, it nevertheless sweeps up to heights of 200 to 300 feet and more above the bottoms of the great river valleys. Not only so, but ever and anon it extends

across the hills and plateaus between adjacent valleys, wrapping the whole land, in short, like a mantle. Again, in many places, we find it heaped up in the lee of hills, the exposed windward slopes of which bear no trace of it, while in certain valleys it shows a similar partial distribution.

Among the organic remains yielded by the löss are some that indicate arctic conditions, while others are strongly suggestive of a steppe climate, and yet others tell us of forest lands. It is impossible that all the creatures referred to could have lived side by side in the same region, and annual migrations will not wholly explain their appearance in the same deposit. The evidence leads to the conclusion that the accumulation of the löss must represent a long period of time during which climatic changes took place. Fortunately now and again the lössic accumulations exhibit a succession of faunal zones—different suites of organic remains occurring at different levels. And a similar and corresponding succession has been discovered in many of the caves of Middle Europe.

A tundra fauna is the earliest of which we have any record in the löss and in the particular caves referred to, and it is worth while to glance for a moment at the former wide distribution of that fauna in Europe. It will be remembered that two of the most characteristic tundra forms are the banded and the Obi lemmings. Now remains of both these species have been met with again and again over all Central Europe—in Russia, Poland, Austria-Hungary, North and South Germany, North Switzerland, France, Belgium, and England. Sometimes they occur in single specimens, at other times they are extremely numerous, the remains of several hundreds having been obtained at various localities. In many places both species of lemming are found together: elsewhere either one or other occurs alone. The banded lemming, as a rule, has left its remains most abundantly in hilly and upland tracts, while those of the Obi lemming are met with more frequently in low-lying areas—a distribution quite in keeping with that which obtains at present in the tundras. That these arctic animals were not mere passing or occasional visitors is shown by the fact that young and full-grown individuals occur together in hundreds at various places, and are associated with the remains of other characteristic arctic animals which breed in the same regions. Thus well-preserved skeletons of arctic fox, having their milk-teeth, have been found lying side by side with the bones of the lemmings. As the arctic fox breeds in June, it is obvious that those young individuals must have died in summer.

Our knowledge of the former distribution of the arctic lemmings is no doubt not so full as it will yet be, but already we have ascertained that these creatures ranged as far south as Central France and the base of the Alps, in Switzerland, and as far west as Somerset, in England. Besides the arctic fox, many other northern forms were congeners of the lemmings in Middle and Western Europe, such as mountain hare, musk-ox, reindeer, glutton, voles of various kinds, ermine, weasel, wolf, common fox, and the now extinct mammoth and woolly rhinoceros. A number of northern birds have also been recorded from the same deposits

as those which have yielded relics of the tundra animals. I need mention only ptarmigans, buntings, snow-owls, ducks, geese, and swans—all of which are in harmony with the arctic character of the mammals, since the same forms are in our day constant summer visitants in the circumpolar treeless lands.

We may note further that just as there is this evidence to the former occupation of Middle and Western Europe by an arctic fauna, so we have abundant traces in the same regions of a well-marked arctic flora. High northern species of mosses, the polar willow, the dwarf birch, and various other northern plants have been met with in superficial deposits over a very wide area, extending from Southern Sweden and England across Middle Europe to the foot of the Alps.

We cannot doubt, therefore, that true tundra conditions have formerly prevailed at relatively low latitudes in Europe. The widespread distribution of the arctic animals and plants just mentioned points clearly to that and to no other conclusion. We may therefore reasonably infer that the climate of Middle Europe must then have approximated in character to that of Northern Siberia—the seasons being doubtless strongly contrasted, and thus compelling annual migrations. With the advent of summer the home of the arctic lemmings was invaded by troops of visitants—by mammoth, woolly rhinoceros, wild horse, saiga, and many others, and by numerous birds. An arctic-alpine vegetation clothed the low grounds, which in the warm season doubtless showed wide stretches of bog and marsh and many shallow lakes. Here and there flourished patches and wider tracts of birch and willow-scrub, but the land was practically treeless. Man, we know, was an occupant of Middle Europe at this time. Perhaps, like the mammoth and the woolly rhinoceros, he may have been rather a summer visitor than a constant denizen, departing for more clement regions at the approach of winter. We shall probably not err in supposing that the winter would have much resemblance to that now experienced in Northern Siberia—long spells of still weather with intense frost, interrupted now and again (especially at the changes of the seasons) by fierce snowstorms, in which the wild animals could hardly fail occasionally to perish in large numbers.

How long these tundra conditions obtained we cannot tell. All we know is that eventually they gradually passed away, and the climate became less arctic. This is shown by the well-ascertained fact that both in the löss and the contemporaneous cave accumulations remains of the arctic animals are confined to the lowest beds, becoming gradually less numerous as we trace them upwards, until they finally disappear. But before the last of the tundra forms has vanished, remains of a steppe fauna begin to occur. In a word, there was no sudden dying out of one fauna and precipitate appearance of another, but a gradual replacement, consequent, doubtless, upon changing climatic conditions.

All the animals already mentioned as most characteristic of the subarctic steppes are represented in the caves and alluvial deposits of West and Middle Europe. Jerboas, pouched marmots, bobacs, and true marmots, tailless hares and others, all formerly flourished in those latitudes. Besides these most characteristic steppe animals, occurred

many other forms which were not restricted to steppe lands, such as mammoth and woolly rhinoceros, marsh-lynx, cave-lion, hyæna, wolf, common fox, ermine, weasel, badger, reindeer, urus, bison, etc. Many birds also were present—all of them species which in our own day frequent the steppes of south-east Russia. Land-shells are also very often found in less or greater abundance along with the relics of the steppe animals just mentioned, most of the shells representing forms that now live in dry steppes, while some are denizens of wooded regions.

The plant-remains associated with relics of the steppe fauna are quite in keeping with the latter, but are upon the whole seldom met with, the conditions not being favourable to their preservation. Trunks and branches of trees occur very rarely, the most common remains being a few thin layers and seams of peaty matter, apparently consisting chiefly of grasses. Nevertheless, we need have no doubt that a steppe flora formerly flourished in Middle Europe, for (as Engler, Ascherson, Petry, and other botanists have shown) many well-known steppe plants survive in the existing flora of that region.

Among the animals associated with the true steppe forms were some which, as we have seen, had already invaded Central Europe in tundra times. Of these perhaps the most notable are the mammoth and the woolly rhinoceros. Probably they were only summer visitors, but in the subsequent steppe epoch they became truly indigenous and very abundant. The broad valleys and open spaces of Central Europe were at that time treeless plains, although woods seem to have existed here and there, especially along the margins of lakes and streams. The climate, we need not doubt, was much like that of the sub-arctic steppes of south-east Russia and south-west Siberia, regions which, like the tundras, are much exposed to wind action. The general character and distribution of the löss prove its æolian origin, and its organic contents are quite in keeping. We may be sure then that dry steppe conditions formerly prevailed throughout Central Europe, and that in those regions dust-storms and snowstorms must have been of common occurrence. We have seen how in existing tundras and steppes the semi-domesticated and wild animals of those regions are now and again overwhelmed in storms and smothered in snow. Now similar catastrophes must have happened again and again in the tundras and steppes of prehistoric times. And we are not left in this matter to mere conjecture, for the carcasses of some of the more notable animals of those days, now extinct, have been preserved to the present in the frozen snows—the famous ice-formations of Northern Siberia. So perfectly preserved, indeed, was the mammoth discovered by Mr. Adams, that its flesh was devoured by wolves and bears, and from the appearances presented by it and others, we cannot doubt that the animals had perished in snow-drifts. Brandt records, for example, that the congested veins and capillary vessels in the head of a rhinoceros examined by him were charged with coagulated blood, as if the animal had died of suffocation; and Schrenck says of another described by him, that the distended nostrils and gaping mouth were highly suggestive of a similar death. It is probable that these animals were summer visitors to the tundras, overtaken by autumnal snowstorms. If perfectly pre-

served carcasses are rare, such is not the case with skeletal remains. In many places throughout Siberia the bones of various mammals occur in enormous quantities, huddled together, as it were, in very limited spots. It seems impossible to account for such hecatombs on any other supposition than that they are the silent records of great blizzards and snowstorms. Even in our own time herds of wild reindeer, with their young, are overcome by snowstorms in the tundras, while in North America great flocks of sheep and cattle frequently perish in the same way. Professor Garman, who draws attention to the disastrous results of blizzards in the great prairie lands of that region, is of opinion that the extraordinary heaps of skulls and other remains of the bison, that are met with here and there in Northern Colorado and Wyoming, are the remains of herds which have been suffocated in snow-drifts.

It is not necessary to suppose that all the relics and remains of the mammoth and its congeners in Siberia are evidence of the destructive effect of blizzards. The animals doubtless met their death under many different circumstances. Sometimes they would appear to have been bogged in swampy holes and morasses. I have referred to the peculiar ice-formations of the arctic coast-lands. These are sheets of ice of unknown thickness, preserved under more or less thick accumulations of earthy and loamy materials. The ice is believed to represent the blown or drifted snows of prehistoric times, which here and there have been protected from complete dissolution by soil and sub-soil flowing over and accumulating upon them, under the influence of thaw, in spring and summer. Such movements of superficial materials are indeed of common occurrence in high latitudes at the present day. The surface of the buried ice-strata is very uneven, being furrowed and trenched by deep ruts and hollows. These depressions are filled up with frozen mud, etc., containing vegetable *débris* and abundant mammalian remains, including those of mammoth and woolly rhinoceros. Probably a large number of the bones may simply have been introduced into the hollows by the flowing soil in spring—they may have been lying originally scattered over the surface. In other cases, however, the animals themselves seem to have fallen or sunk into the depressions. All the evidence leads to the inference that in the warm season these high northern regions were visited abundantly by mammoths, rhinoceroses, horses, bisons, wapiti, and others. Such being the case, it is not hard to understand how the bulkier animals might now and again become trapped in the treacherous bogs and subjacent muds that covered and concealed the ice-formations and their deep clefts and depressions.

When we turn to the löss of Europe, we meet with copious evidence to show that the wild animals of our prehistoric steppes and tundras were often done to death in their hundreds and thousands. Again and again great heaps and accumulations of their skulls and skeletal remains have been encountered in our lössic accumulations—appearances exactly recalling the similar bone-finds of Siberia and North America. The deposits in which the European bone-finds occur are of wind-blown origin, and we seem justified therefore in concluding that the animals perished in snowstorms. In these low latitudes, however, we could not

expect to meet with ice-formations like those of the tundras. But that drifted snows did formerly accumulate in Middle Europe, and were preserved for long periods under coverings of sand and other materials, we have good reasons for believing. Indeed, even at the present day the drifted snows in south-east Russia are occasionally buried under sand and so persist for years. In one case recorded by Borszcow, what appeared to be an ordinary sandhill proved to be a mass of congealed snow cloaked in sand about a foot in thickness. Immediately under the surface the snow was granular and névé-like, but a little deeper it was firm and solid like ice. This was in one of the tributary valleys of the Ilek, in the steppes south of Orenburg, about the 50th parallel—a relatively dry region. If in a low-lying region so far south snow can be preserved in this way, we may readily believe that in the steppe epoch of Middle Europe snow-drifts similarly protected might now and again have persisted for years. But it was during the preceding tundra epoch that this would be most commonly the case. And much interesting evidence is forthcoming to show that in many places thick sheets of congealed snow did accumulate and become buried and preserved at that time. Many of the so-called "rubble-drifts" of Middle Europe—sheets of rocky rubbish which have travelled down gentle hill-slopes and spread themselves over the adjacent low grounds—point to the former presence of great snow-drifts, in and upon which the rock *débris* travelled. These were not glaciers, but simply sheets of névé-like snow, charged with and covered by earthy and rocky *débris*, which kept moving outwards, more especially in spring and summer when the heaps were more or less rapidly melting. The occurrence in this *débris* of bones of the reindeer and other mammals shows that the deposits belong to prehistoric times. Again, certain phenomena connected with the river gravels of the same period lead to the conviction that the drainage was often interfered with by snow-drifts in tundra times. The river valleys would seem to have become filled in places with alternate sheets of congealed snow or ice and layers of gravel and shingle. Long afterwards, when the interbedded strata of ice melted slowly away, the associated river detritus quietly settled down, and owing to the differential movement of the subsiding materials, the longer stones naturally arranged themselves in lines of least resistance—so that now we find them most usually standing on end in the gravel beds.

Thus, apart from the evidence supplied by the bone-accumulations of the löss, we have good reason to believe that snow-drifts were of common occurrence in Middle Europe in prehistoric times. Doubtless most of the snow which covered the plains of our continent in winter melted and disappeared in summer, just as is the case in the tundras and steppes of our own day. The carcasses of animals that may have perished in blizzards would thus most frequently become uncovered in spring, to be devoured by hyænas, wolves, and bears, and the disarticulated skeletons might often be bleached and weather-worn before they were finally buried in löss. Nor was it only in plains and open valleys that sudden death may have overtaken large numbers of animals at a time. In tundras and steppes alike the wild and semi-wild denizens of the plains

seek refuge from the drifting snow in the fissures, caves, gullies, and ravines of the hills and mountains, where they are sometimes frozen to death or smothered in snow. Herbivorous and carnivorous animals thus often perish together, for in the presence of a common danger—whether it be prairie or forest fire, or flood or blizzard—natural antipathies and animosities are forgotten, and all alike struggle to escape.

Man, as I have already mentioned, lived in Middle Europe in tundra times, and we have abundant evidence of his presence there throughout the succeeding steppe epoch. Again and again his relics and remains have been met with at all levels in the löss throughout Central Europe. Thus in the valleys of the Danube and some of its tributaries they have been discovered in undisturbed löss at depths of from twenty to nearly a hundred feet from the surface. Not a few of these finds evidently represent old prehistoric camping stations — marked by the presence of quantities of charcoal and ashes, burnt and calcined bones, together with worked flints, bones, and ivory. Among the animal remains are those of mammoth, woolly rhinoceros, musk-ox, reindeer, elk, horse, lion, glutton, bear, wolf, arctic fox, common fox, and hyæna. Nor is it only in the löss that we have human relics associated with the tundra and steppe faunas. Similar finds have been recorded from many caves and rock shelters, of which we may take the rock shelter of the Schweizersbild, near Schaffhausen, as a good example. The deposits at that place show a clear succession, and tell a highly interesting tale. The following is the sequence, the beds being numbered from below upwards:—

6. Humus-bed.
5. Grey Relic-bed.
4. Breccia-bed, with Upper Rodent-bed.
3. Yellow Relic-bed.
2. Lemming-bed.
1. Gravel-bed.

With the lowest bed (No. 1) we need not at present concern ourselves, beyond remarking that it is obviously of fluviatile origin. All the overlying beds are clearly of sub-aërial formation—the flooded torrential water which laid down the gravel-bed (No. 1) had left the rock shelter high and dry before the succeeding lemming-bed began to accumulate. This latter is a yellowish earth, charged with fragments of limestone, detached by the weather from the overhanging rock. Scattered through this earth are abundant remains of arctic lemming, arctic fox, mountain hare, reindeer, glutton, and a number of other forms which are constant summer visitors to the tundras. The banded lemming is the most plentifully represented species, and next to it in abundance comes the alpine hare. In close association with this tundra fauna occur flint implements, and awls, chisels, harpoons, and needles of bone and horn. Only one old hearth with its ashes was encountered, and from the fact that no calcined bones were met with, while the number of worked bones and antlers was relatively small, it may be inferred that man was not a persistent occupant of the rock shelter during the slow

accumulation of the lemming-bed. The same conclusion is suggested by the occurrence, especially in the upper part of the bed, of abundant traces of various birds of prey, which appear to have been able to nest undisturbed on the rock and in its crevices.

It cannot be doubted therefore that during the formation of the lemming-bed an arctic climate reigned in North Switzerland. Towards the upper part of that bed, however, we find evidence to show that tundra conditions were gradually passing away. This is indicated by the fact that some of the tundra animals, so common in the lower part of the stratum, become scarcer, and at last cease to appear, while at the same time a few representatives of the sub-arctic steppe fauna enter upon the scene.

The next succeeding stratum (Yellow Relic-bed) proved to be rich in human relics. It yielded some fourteen thousand flint implements, and a large number of worked bones and antlers, comprising needles, bodkins and awls, chisels, harpoons, whistles, and other objects. Bits of wood, worked and charred, and fragments of worked and unworked lignite were also obtained. Besides these, drawings and patterns were found on reindeer-antlers, on bones, and on tablets of limestone, while many shells, fossils, and teeth of the arctic fox and the glutton were met with, bored and pierced, as if they had been used for necklaces and other personal ornaments. The presence throughout this relic-bed of nuclei or cores from which flints had been struck, of abundant chips and splinters, of old hearths, ashes, and burnt bones, shows that the reindeer hunters were for a long time constant occupants of the rock shelter.

Turning to the abundant animal remains, we find that these represent no fewer than forty-nine species, viz., thirty mammals, fifteen birds, three amphibians, and one fish. All the most characteristic tundra forms—the banded lemming and its peculiar associates—are now absent, and in their place we find a true steppe fauna. Amongst the new arrivals are red suslik, pika, and true hamster, and associated with these are such constant visitors of the steppes as manul cat, wild horse, dzeggetai, and various birds. Certain forms which appear in the lemming-bed are still represented, as arctic fox, glutton, and others —all of which, however, in our own day range south of the true tundras. Their presence therefore is not out of keeping with the characteristic steppe forms. It is clear therefore that in North Switzerland a tundra fauna was eventually succeeded by a steppe fauna.

Towards the top of the Yellow Relic-bed once more new arrivals begin to put in an appearance, and their presence seems to show that the climate was again gradually changing, for they include red-deer, roe-deer, wild boar, squirrel, pine marten, and beaver, all of which belong to a forest fauna.

The next stratum in succession is the Breccia-bed. This consists of small fragments of limestone, either lying loosely together or cemented by calcareous matter. Relics of man were not so common in this bed, although occasional splintered bones and flint implements occurred all through it, and in places were even abundant. About midway between the top and bottom of the Breccia occurred a layer of dark earth, in

which human relics and the remains of various rodents were conspicuous. It would seem that during the accumulation of the Breccia-bed small groups of reindeer hunters only now and again visited the rock shelter: it was evidently not so continually occupied as it had been. The animal remains met with in the stratum undoubtedly tell a tale of changing climatic conditions. Amongst the species represented are reindeer, pika, hare, squirrel-tailed dormouse, garden dormouse, squirrel, water-rat, various voles, shrews, mole, ermine, marten, and others. This is obviously a mixed fauna—a few of the steppe animals being still present, but the larger number of the species are forest forms. The fauna of the Breccia-bed, in a word, marks the transition from steppe to forest conditions. Obviously the climate was gradually improving—the forests continuing to increase at the expense of the earlier steppe flora.

In the Grey Relic-bed that succeeds we lose all trace of the characteristic steppe fauna. The most abundant remains are those of red-deer, roedeer, horse, and ox, and with these are associated relics of a number of other forms, such as badger, wild cat, hare, urus, goat, and sheep. The steppe fauna had now obviously become replaced by a forest fauna. Palæolithic man—the reindeer hunter of the tundras and steppes—had also vanished, and his Neolithic successor now occupied the rock shelter of the Schweizersbild. The Grey Relic-bed and the overlying Humus-bed tell a most interesting tale, but into that I cannot go. It is sufficient to note that the old reindeer hunters seem to have departed before forest conditions had been fully established. We may surmise that as the climate became warmer the reindeer gradually withdrew from the Alpine Vorland. Probably it had already become somewhat scarce during the accumulation of the Breccia-bed—in which, as will be remembered, traces and remains of it and its hunters become less and less common. One can hardly doubt that the emigration of the reindeer and the final exodus of Palæolithic man from North Switzerland were contemporaneous events, brought about by changing climatic conditions. We can picture to ourselves the old race of hunters, with the contemporaneous steppe fauna, gradually passing east and north-east, while the forests continued to encroach upon and overspread the fertile lands of Central Europe. It is possible that Neolithic man may here and there have come into contact with his Palæolithic predecessor, but of this we have no evidence. All we certainly know is that the latter vanished from Central Europe with the steppe fauna, and that when Neolithic man made his earliest appearance a forest fauna was in possession of the land.

(*To be continued.*)

THE YEZIDS.

By Victor Dingelstedt, Corr. Member, R.S.G.S.

(*With a Map.*)

There is less love than hatred and dislike between nations, and it is not so much antagonistic interests as ignorance and misconception that are at the bottom of it. Anything serves as a pretext for mutual hatred, and the pretext is the more easily found the less the parties know of each other. Among small but ancient nations, that have more particularly suffered from the ill-feeling of their neighbours and the world in general, and which still remain under a cloud of misconception, and are consequently objects of aversion, must be reckoned the Yezids, akin to the Kurds, but differing from them in their creed and manners. They are consequently known as devil-worshippers, and though the worship of the Devil, if not outwardly yet all the more sincerely in spirit, is not at all uncommon or severely reprehended even among the most Christian and civilised nations, yet the horror inspired in pious people at the very mention of respect for such a disreputable though fantastic personage is very great indeed. Do not we find in the monumental and otherwise really splendid encyclopædic work published in Edinburgh, the following information about these poor Yezids? "Yezidis," says Albrecht Socin, Ph.D., professor in Tübingen (vol. xvi. p. 49, *Encyclopædia Britannica*), "form the population of the Sinjar range." "He who encounters the uncanny figure of one of these people will hardly be able to restrain a slight shudder, especially if he remembers the graphic description of the Yezidi robbers in Morier's *Ayesha*." We confess to having no recollection of those terrible robbers, and we are convinced that a people is not to be fairly judged by its real, much less its imaginary, robbers. Unfortunately, in the whole encyclopædia of twenty-four big volumes, this is the only notice of the Yezids, which is the more to be deplored as they are neither robbers nor, strictly speaking, devil-worshippers. At any rate their Devil is not so black as he is painted. If it were only to redress the injustice done to them, the study of this small people would certainly have some attraction in the eyes of most readers of this journal: but there is also another motive for approaching it. The social and ecclesiastical organisation of the Yezids, their customs, habits, and ideas, certainly possess some historical and truly scientifical interest. In their case we have to do, not with a savage people, like that of the interior of Western Australia, so graphically described in the *Magazine* by that indomitable traveller, the Hon. David Carnegie, nor with such devil-worshippers as the Kondhs and Kols in Central India (if they also are not calumniated), but with a remnant of an ancient, formerly rich and prosperous, community, long ago arrived at a certain degree of culture, but arrested in its progress by adverse circumstances, and now sadly contemplating the loss of its comparative prosperity and independence along

with all that is dear to them. It is a state the ancestors of many civilised nations have passed through, and it is also a fast disappearing state, of which, before long, hardly any vestige will remain. Though the subject of this paper is properly the Yezids, yet we may be allowed, perhaps, to speak occasionally of their congeners the Kurds, with whom they have much in common, but who detest them cordially.

Besides some personal knowledge the author of this article had opportunities of acquiring during his long sojourn in the Russian province of Erivan, partly inhabited by Yezids, he has gathered his principal information about this people from a reliable Russian source, viz., two contributions to the *Zapiski* of the Caucasian section of the I. Russian Geographical Society from the pen of Mr. Eghiazarof, who is very familiar with the Yezids, and by Mr. Kartsef, formerly Russian consul in Mosul. After a few words about the distribution, number, and language of the Yezids, we will speak about their religious and social organisation, their family life, their habits, and the position of women among them.

Geographical Distribution.—Kurds, under their ancient name Gadru, known in Persian writings as Kudraha, and as Kardoukhoi and Gorduaioi to the Greeks, inhabited from time immemorial the eastern Taurus, east of the Euphrates (not the Taurus in Cilicia), and the Zagros or Zagorus range. In course of time they spread farther, and now occupy a vast country limited on the west by the Euphrates, on the south by the plains of Mesopotamia and the mountains of Luristan, on the east by the chain of Takh-Verdy, and on the north by the Araxes. There are Kurdish tribes considerably beyond these limits, as in Khorassan, in the Russian provinces of Erivan and Kars, and west of the Euphrates, but within these limits they constitute the majority of population. This is the country of the Kurds or "Kurdistan" in its proper sense, though this name is sometimes applied only to the province of Ardilan, or Persian Kurdistan. In this region, with the exceptions of the country immediately to the north-east and south of Lake Van and the sanjak of Hakkiari on the east of Judi, where is found a considerable Armenian and Nestorian urban population, the Kurds constitute a very considerable majority, not only of the rural, but also of the urban inhabitants. They are concentrated in the mountains of Bingol-dagh (in the old sanjak of Dersim—vilayet Mahmuret-el-Aziz), on the southern slopes of the Kharzan-dagh and Judi, in the mountains of Zagros and in the greater part of the Persian provinces of Ardilan and Kerman.

The Yezids dwell principally in the mountains of Sinjar in the province of El-Jezireh, north and west of the ruins of Nineveh, but a certain number of them are to be found on the west of Ararat and in the Russian district of Kaghysman.

The entire area of the country, where the Kurds greatly outnumber the other elements of the population, may be roughly estimated at 145,530 square miles, about that of Prussia, Würtemberg, and Baden taken together. On the whole, it is a rough, dry, inhospitable, roadless country, traversed by numerous chains of mountains—Kysylky-dagh, Bingol-dagh, Ala-dagh, Palanteken on its northern border, Shah-Verdy and Zagros on the south-east, Judi and Kharzan-dagh in the middle.

Of the rivers may be mentioned the Euphrates, Zab, Diyala, Albagh, Kara-su.

Number.—The exact number of the Kurds is not known. Col. Kartsef estimates them at from two and a half to three millions, the Yezids furnishing only a very small contingent. Until the beginning of the present century they constituted, however, a rich and powerful community, but in 1832 the Sunnite Kurds, under the leadership of the Pasha of Revanduz, made a war of extermination against them, and since then their number has considerably declined and is still diminishing. According to the estimate of the Russian consul in Mosul in 1880, they were then about one hundred and ten thousand, of whom some fifty thousand were settled in Turkey, seventy-two thousand were nomads, and ten thousand lived in Russian territory. According to a more recent estimate of Colonel Kartsef (*Zapiski* of the Cauc. Sect. vol. xix.) they number only from thirty to forty thousand.

Language.—The Yezids, in common with Kurds, have a language appertaining to the Iranian group of the Indo-European or Indo-Germanic stock. This Kurmanji possesses a number of dialects, not differing much from one another, except the "Zaza" dialect, which is spoken in Eastern Mesopotamia (or Murad-chai) by the Dersimly Kurds, or Ali-Alla. Its main characteristics are the great brevity of its words and an astonishing simplicity of grammatical forms. Suffixes and prefixes, distributed with apparent capriciousness, are very numerous and important. The spoken language makes no agreeable impression on the hearer, for though fairly rich in vowels it is yet richer in deep guttural sounds, while the letter *r* is pronounced with a strong roll from the very bottom of the chest. This is not the place to enter into minute particulars, and it will be sufficient to mention that Kurmanji was studied a hundred years ago by the missionary, Father Garzoni (*Grammatica e Vocabolario della Lingua Kurda*), and more recently by numerous linguists, of whom the most noteworthy are Rich, Lerkh, A. J. Khodsko, Fr. Miller, Rae, Socin, Yusti, Aug. Zhaba, Zagurski and Eghiazarof. The transcription of Kurmanji into a written language presents enormous difficulty, and there is little probability that a European, who has studied this language only from books, will be understood by a Kurd or Yezid.

Physical Formation.—The Yezids, as indeed the Kurds in general, present a typical example of a close relation between the character of a country and that of its inhabitants—wild, rough, uncultivated, healthy country, and wild, hardy, sturdy, uncultured inhabitants. On the whole, they are a fine manly race. Tall, or of middle stature (from 65·2 to 66 inches), they are slender, strong, graceful, powerfully built, with a large chest from which issues a strong deep voice, audible afar, and a clear, keen eye, open and confident, fierce and angry alternately. They have regular features, the nose of moderate length (about 56 mm.). They are dolichocephalous and have a rather small head (the mean circumference 534 mm. or 21 inches). The legs are rather short and the sole of the foot rather large (256 mm.). Their hair is usually brown, as are also their eyes. But there are two different types; the most frequent

is taller, with auburn or black hair, fine regular nose and brown, sometimes blue, eyes; and the other, of shorter stature, has longer features, light brown eyes, and a large, irregular nose. The Yezids shave the hair on the head, leaving only a long, thin forelock.

Religion.—As the Yezids have a theocratic organisation, and as their creed not only serves them as a national bond, but exercises also a powerful influence on their minds, we must necessarily dwell at greater length on this subject.

There has been much controversy about the religion of the Yezids, some considering them as Mussulmans, others as Nestorians, and others again as followers of Zoroaster. Fearing persecution and contempt, the Yezids envelop their creed in mystery, so that it is difficult for foreigners, whom they distrust, to obtain a thorough knowledge of it. Being unlettered and very ignorant, they have, on the other hand, but vague and pretty divergent ideas themselves as to what they ought to believe or to reject. The difficulty of learning the substance of their creed is further increased by their hypocritical behaviour in the presence of Mussulmans, whose wrath they fear. According to Mr. Layard, who lived among them, they have a sacred volume, containing their traditions, their hymns, directions for the performance of their rites and other matters connected with their religion; but it is so jealously guarded (at Baasani or Baasheikha), and is regarded with so much superstitious reverence, that it is impossible to obtain a copy of it, or even to see it, either for love or money. It is known that they respect the Devil, represented as a peacock, and carry about his image. According to a natural tendency of the human mind to exaggerate whatever seems evil, this respect paid by the Yezids to Melek-Taüs, or the fallen angel, as they call him, has been thoroughly misconstrued. Very unfortunately for them it has been interpreted by their neighbours as a formal worship of the Devil, and consequently their belief in God has been denied. We believe that this is a great error. In fact, they have a monotheistic doctrine of their own, bearing some analogy with the teaching of Zoroaster, and certainly influenced, as in the case of other religious creeds, by the various tenets of their neighbours. They do not directly worship the Devil, as is shown by the text of their principal prayer, which we give *in extenso*.

The Yezids' chief Prayer.—"Amen, Amen, Amen! Sole, Almighty Creator of the Heavens. I invoke Thee, through the intermediation of Shamsedin, Phakredin, Nasredin, Sijedin, Shekhisin, Sheikh Bakra and Kadir-Rakhmana.[1] Lord! Thou art merciful and gracious. Thou art God, and from eternity Thou art eternal. Thou art King of all lands and kingdoms, of all creatures seen and unseen, of all saints. Thou art the fountain of life and happiness, Thou art worthy of praise and thanksgiving, Thou art the source of blessings and boundless love, Thou art terrible and glorious. Thy abode is beyond the heavens. Lord! Thou art the protector of travellers, Sovereign of the moon and of the darkness, Master of the heavenly throne. Thou art a God of benevo-

[1] The meaning of these names is not certain. Some believe that they are archangels, others different attributes of God. Perhaps they are the seven Amshaspands of Zoroaster.

lence, supreme Judge of kings and subjects, Thou art the administrator of the whole world. Lord! Thou hast created the sinner Adam, Jesus and Mary. Thou art the fountain of joy and beatitude. Lord! Nobody knows Thy appearance: Thou hast no face; it is not known what is Thy stature, or Thy movements, or Thy substance. Thou art not a substance, Thou hast neither feathers, nor wings, nor arms, nor voice, nor colour. Lord! Thou art an enthroned King and I am a fallen sinner; a sinner, but not abandoned by Thee; Thou hast led me out of darkness into light. Lord! pardon my guilt and my sins. Oh God! Oh God! Oh God! Amen."

There is, then, no mention of Melek-Taüs, the supposed divinity of the Yezids. In fact, they consider him only as an archangel temporarily in disgrace; they believe that God will pardon him and allow him again to occupy the foremost place in the hierarchy of angels. There are some who believe that he is already reconciled with God. At any rate, the Yezids do not arrogate to themselves the right to interfere in the relations of God with his angels; they venerate them all alike. As to the reason why God was displeased with his former chief servant there is some disagreement among them. Some ascribe it to the deceit he practised on Adam and Eve, others to his unwillingness to recognise the superiority of Adam, as demanded by God. The Yezids have certainly accepted some of the doctrines introduced by the followers of Zoroaster in later times, when his original monotheism was corrupted into a theological dualism. They recognise, for instance, seven divinities, which are, of course, the seven Amshaspands or immortal saints of the Zend-Avesta; but, curiously enough, these divinities bear the names of seven disciples of Sheikh Adi, the supposed founder of their creed, viz. Melek-Taüs, Sheikh Hassan, Sheikh Shems (the sun), Michael Abu-Bekr, Asrail-Sijedin, Shatmail-Nasredin, Nurail Fakhredin. As already mentioned, Melek-Taüs, the angel-bird, is represented in the form of a peacock; his images, placed in the temple of Lalish and in the houses of the Sheikh and the Emir, are carried about at the collection of gifts for these dignitaries. There are two explanations of this apparent worship of the Evil Spirit. We have already given the first, according to which it is not the part of man to interfere in the relations of God with his angels, fallen or not; but their duty is to venerate them all alike. According to the second version the Yezids do not believe in the Devil at all. In opposition to the belief of their neighbours they do not regard Melek-Taüs as an evil spirit, but as a true divinity. There is in the history of religions many instances of such a confusion, in consequence of which the God of one people is the Devil of another. While in the Avesta, to take one example, the evil spirits are called *daêva* (Persian *dîv*), the Aryans of India, in common with the Romans, Celts, Letts, and Slavs, gave the name of *dêva* (*divin*, divine, *divny*) to their good or God-like spirits. Asura is a deity in the Rig-Veda, and an evil spirit only in later Brahman theology. Zoroaster or Zardusht taught that the beings whom his opponents worshipped as gods, under the name of *daêva*, were in reality powers by whom mankind are unwittingly led to their destruction. False gods in the minds of many

people—and they are all false gods which are not ours—are equivalent to devils.

The Yezids worship also the Sun (Sheikh-Shems) and the Moon. They see in the former a reflection of God's light, and repeat a prayer at sunrise. They consider also as sacred the four elements, or *gysm*, viz. earth, water, air, and fire. The most sacred of these is fire, for in it they see God's spirit, and believe that at doomsday fire will destroy everything evil and unclean on the earth, and thus restore it to its primeval purity. As with all Kurds, with them the hearth is a sacred place. The Yezids recognise one hundred and twenty-four thousand prophets, among whom the founder of their creed, Sheikh Adi, is the chief. Their creed commands them to believe in God and love Him, to respect prophets and parents, to practise charity, and mutually to succour one another; it prescribes prayer, fasting, and sacrifice; it declares the equality of men before God, and the immortality of the soul. It forbids blasphemy, falsehood, calumny, the taking of an oath, murder, vengeance, adultery, incest, marriage with one of another caste, usury, and cupidity. Theoretically he who breaks these commands ceases to be a Yezid, and can no longer be accepted as such. Such is the substance of this creed.

We will not linger over the very childish conceptions of the Yezids about the creation of the world, given at some length by Mr. Eghiazarof (*Zapiski*, vol. xiii.), and before him by Mr. N. Siuffi in the *Journal Asiatique*, 1885. In the main it is only a variation of the account in Genesis; the most striking variation being the belief, not however concurred in unanimously, that Eve was formed from one of Adam's ribs, not by God, but by Melek-Taüs. There is also a controversy as to the initiative in the first sin: according to some, Melek-Taüs seduced our first parents to eat grapes and thus caused them their first pain (stomach-ache); while, according to others, God himself directed Melek-Taüs to devise some means of peopling the earth, and for this end to lead Adam and Eve out of Paradise. They had two sons and two daughters, who, on arriving at puberty, intermarried, and thus committed the sin of incest. When Eve became old, Adam married a *hori* (houri), and thus first introduced bigamy and infidelity.

The Origin of the Yezids.—Like most oriental peoples the Yezids consider themselves to be of very ancient origin. *Yezd*, or *Ezd*, signifies, in old Persian, God, and therefore *Yezdi*, as the Yezids or Yezidi call themselves, signifies "of God" or "God's." In the traditions of this people *Yezd* must be an abbreviation of *aez-da-Khúda*, that is, "created by God." Yezd is represented in material form as half angel and half man. He remained a bachelor long after the marriage of Adam, say the Yezids, but at last, goaded on by desire, and unable to marry a mortal's daughter, being himself half angel, sought the assistance of Melek-Taüs, who presented to him a *hori*, and from this union originated a pious people, the Yezdi or Yezids. The question whether the name Yezid is derived from that of some kalif of the Ommiad dynasty is a subject of controversy. Some Yezids deny all connection with the kalif of this name, accused by Shiites of the treacherous murder of Ali's son Hosein, who is considered by them as their true Imam. But it is not impossible that

this rejection comes only from fear of persecution on the part of the Shiites, for the Kalif Yezid is venerated by the Turkish Yezids as the forerunner of the founder of their creed, Sheikh Adi. However it may be, the Yezids are certainly considered by Shiites as descendants of the Kalif whose name is odious to them, and this belief was, and still subsists, as an effectual motive for hatred and persecution. For different motives the Yezids are equally hated by Turkish and Russian Kurds, and in fact by all their neighbours, Christian and non-Christian. This aversion has stamped on the character of this people, otherwise estimable, an unamiable distrust of all strangers.

It is pretty certain that the sect of the Yezids was founded by Sheikh Adi. He is a historical personage, though it is exceedingly difficult, if not impossible, to establish any historical facts out of the thick mist of very fantastic stories current about him. According to an Arab author—Kasi-Akhmed-Ibn-Khallikhân—an extract from whose work was published by Mr. Siuffi in the January number of the *Journal Asiatique* for 1885, his family originated in Hakkiari, or Hekiari, Kurdistan, but he himself was born in Syria, near Baalbec, in the village of Bekdar, about the year 465 of the Hejra (1086). His pedigree runs thus: Sheikh-Adi-ben-Mussapher, ben-Ismail, ben-Mussa, ben-Marvan, ben-el-Hassan, ben-Marvan-el-Hakkiari. He lived ninety years. It is said that, at the head of his disciples, he attacked a Christian monastery, Lalish in Muzurdagh, some twenty-seven miles from the once flourishing town of Mosul, turned out the monks, and established there his sanctuary, which still exists. Through the death of Sheikh Adi, deified by his followers and credited with all kinds of power and virtues, Lalish has become the Mecca of the Yezids, who have attached to it a numerous staff of servants, and resort there for an annual festival, lasting seven days.

The present social organisation of the Yezids (already legally abolished in Russia) we will now consider in some detail. It is attributed to Sheikh Adi.

Social Organisation.—Though Kurds by origin, the Yezids have lived, in consequence of their schism, in great isolation from their conquerors and from their Christian neighbours, and have thus preserved, better than the Kurds, their judicial system, the mainspring of their solidarity. They are also more peacefully disposed, and lead a more sedentary, agricultural life. Otherwise, save their religious views, and everything that depends on them, they have much in common with the Kurds—language, customs, family organisation, costumes, etc.

Castes.—The most curious feature in the social organisation of Yezids is their division into two completely separate castes, *mirids* (laymen) and *ruhans* (clergymen), between whom any matrimonial bond is strictly prohibited, and is considered as incest. There is a further subdivision of the *mirids* into nobles and commoners, but this distinction is accidental, and the passage from one rank to the other is not impossible. *Ruhans*, on the other hand, fall into further subdivisions of a hierarchical order, having almost the same importance as the castes, and these are—(1) *Sheikhs*, called upon to perform all religious rites and ceremonies, and

boasting a descent from one of five saints or patriarchs (Shamsedin, Phakredin, Nasredin, Sejedin, and Sheikh-Sinn); (2) *Pirs*, ordinary priests; (3) *Fakirs*, mendicant priests, distinguished by their rags, and the severity of their abstinence from all worldly goods; (4) *Quaeval* or *Kaevals*, sheikh's messengers, intrusted with the collection of taxes, and also itinerant judges and popular bards and reciters of tales; (5) *Auhan* or *Aran*, also *Chavishi*, inferior clergy; and (6) *Kochaks* or *Kocheks*, properly servants in the temple of Lalish, but also expounders of oracles and healers.

All these different orders have their distinguishing headgear and dress, and their distinct regulations. Sheikhs wear black turbans and white garments; Pirs, a red turban and black garments; Quaevals carry with them on their official visits the emblem of their religion, or *sinjak*, in the form of a cock.

The clergy of all ranks enjoy particular respect, their persons and homes are held inviolate, they take precedence at public gatherings; and the first two orders, the Sheikhs and Pirs, possess the most dreaded power of excommunication.

The Head Sheikh.—The ruhans or clergy, being superior to the mirids, their head or chief sheikh is naturally the person of most consideration and authority among the Yezids. The chief sheikh, reputed to descend from Sheikh Adi, the founder of the creed, is their spiritual head, the principal interpreter of scripture, the chief spiritual judge, a sacred person, whose hearth is considered as a sanctuary only second in importance to the temple in Lalish, and whose will must be implicitly obeyed. He resides in Mosul. His powerful weapon is excommunication. He presides over a tribunal, composed of ecclesiastical superiors, which has jurisdiction in religious offences, questions relating to marriage, and disputes between the clergy. His charge is hereditary, in direct succession, but if his eldest son be considered unworthy he may appoint another to succeed him. He lives on voluntary offerings from his flock.

The Emir.—But the Yezids have also a secular chief, who exercises a secondary authority over them. He is a scion of the ancient and highly venerated family of the Beni-Ummeia, and resides in Badrish, or Badrie, a small place near Mosul. His title is Mir-Khoji or Emir-el-Khoji. He occupies a rather difficult position between the Turkish Government, which has not much respect for him—and whose favour he is obliged to buy at the cost of his dignity, and by heavy pecuniary sacrifices—and his subjects or co-religionists, who highly reverence him, and are naturally aggrieved at his dependence. He has now no more than the shadow of his former importance. Like the chief sheikh he lives on voluntary contributions, but has at his disposal fifty quaevals, who contrive to obtain for him, at their annual visits to each Yezid community, about six thousand Turkish pounds.

Tribal Divisions.—Besides this general division of all Yezids into the above two great social classes or castes, with their respective spiritual and secular heads, there exist among this people some gradually disappearing vestiges of their ancient tribal organisation. The institution of ecclesiastical and secular superiors, consequent on their adoption of the

teaching of Sheikh Adi, did not efface, though it has certainly weakened, their tribal organisation. With the Kurds the chief or head of a tribe is always called sheikh, whereas the Yezids reserve this name for their ecclesiastical dignitaries, calling their tribal headman or chieftain only *aga-e-el*,—*el* signifying tribe, and *aga*, master. A tribe (*ashiret* or *el*) is a union of several family stocks or small communities (*ruspiti*) recognising the same tribal chief. An enterprising and influential man can always form a new tribe. We do not know the actual number of the Yezid tribes, always very unequal in numerical importance. There are in Russian territory only two tribes, the Sipiki in the province of Kars, and the Hassannia in the Government of Erivan. A tribe may consist of an indefinite number of separate communities or *ruspitis*, each having at its head an elder or *ruspi*, appointed by the chieftain or *aga-e-el*. This man appertains usually to a most respected and ancient family in his tribe; he exercises a patriarchal, pretty absolute authority, considering his people as a kind of grown-up children, wanting in everything advice and protection. His office is hereditary, but an unworthy elder son may always be dispossessed in favour of a younger, more capable, brother, as also, of course, in favour of a representative of any other family that attains pre-eminence. Besides appointing the *ruspi*, the tribal chieftain or *aga* is considered as the natural judge, arbitrator, and administrator. He is the president of the tribal tribunal, a court of justice of the most simple description, held occasionally at some public place, open to every one, and in which the evidence is heard, the verdict given, and the sentence executed in public without formalities and without delay. The judge can consult whom he pleases, and is expected to grant a hearing to any one out of the audience who has evidence to give on the question. Proof is founded on the mere affirmation of the witnesses, and only occasionally is recourse had to an oath on the part of the accused. The usual formula is as follows: "May God destroy my house, and my children, and extinguish my hearth, if I am wrong, but may God be my avenger if you are wrong." The *aga*, as judge, has the right of inflicting a fine, corporal punishment, imprisonment, and, in the most serious cases, banishment and confiscation of property (*talan-kyryn*).

The *aga* receives from his tribesmen presents of various kinds (*bakshish* or *peshkesh*) on all important occasions, festive or mournful, such as feast-days, births, marriages, circumcision, funerals, etc.; and he also receives fees when called upon to arbitrate in a dispute, and on the nomination of a *ruspi*. These presents differ in value, according to the means of the donor, and the importance of the occasion, ranging from a sugarloaf, cotton, woollen or silk stuffs to a pair of oxen or horses. The *aga* has besides the right to exact certain personal services from his tribesmen, principally field and house work, such as reaping, gathering, carrying and threshing corn, sheep-shearing, the transport of his household during the summer migrations, etc. He has also a share of the fines imposed on criminals, and he succeeds to escheated and confiscated goods.

The *aga* is surrounded with considerable reverence, his person and family are held inviolate, his hearth is a sanctuary, a number of relatives

and servants accompany him in his journeys and execute his orders, and besides—a valued privilege—a numerous retinue of friends and men of consequence attend him on his visits. In return for all this the *aga* is expected to render himself useful to his people, to defend their interests, to protect their widows and orphans, to take the initiative in bringing help to the needy, sick, and sufferers from any other misfortune.

The Ruspi or Headman.—In all these functions the *aga* is directly assisted by the *ruspi*, the village headman, similar to the Indian *potail*, nominated or appointed by him. Like his chief, the *ruspi* combines administrative and judicial functions; he is also a policeman, collector of taxes, and general superintendent of the affairs of his *ruspiti*. When an itinerant tradesman visits his village he is expected to examine his goods and appraise them, and in default of his recommendation the tradesman has to depart. In case of disputes, broils, or damage committed he acts as mediator, calling to his aid, if he likes, the council of elders.

The Family.—Besides the tribe there is the family and the expansion of the latter into a *tagra*, as also the aggregation of a number of families constituting a *gund* or *obae* (gentes), another organised body distinct from the tribe, which may have preceded or accompanied the institution of the family proper. It is known that the patriarchal theory can no longer be accepted as explaining the history of the formation of the tribe. The question, whether the tribe is anterior to the family or not, is difficult to answer, but the examination of the actual, perhaps very advanced, organisation of the Yezids seems to show that family bonds are stronger with them than those of the tribe. In case of disputes arising in a family or a *tagra* the *aga* or *ruspi* invariably sends back the plaintiff with the words, "Go and obey thy elders." All members of a family or clan share one another's liabilities, and are collectively responsible for a murder committed by one of them. In case of the insolvency of the offender the fine (*serime*) imposed on him, or the *rira* (the price of blood), has to be paid by his nearest kin, and, in their default, by other members of the clan. The family proper consists of parents and their children, married or unmarried, living in the same house or under the same tent. When extended so as to include blood relations and connections to the second and third degree it is called a *tagra*—a stock or clan. A still wider expansion of the family constitutes a *gund* or *obae*, that is, village or camp, though perhaps this last, for all we know, may be only a sub-division of a tribe, necessitated by purely local circumstances. However this may be, there is a strong sense of solidarity between the members of a family proper and the *tagra*.

Respect for parents and older persons is enjoined by the religion of the Yezids, and is considered by them, as by the Kurds, a virtue. The head of a family is the sole proprietor of its possessions, and holds full control over his wife and children, who are bound to obey him. Only personal objects of dress and ornament are the separate property of a wife. The husband can inflict on her severe punishments, and even cut off her nose or ears in case of infidelity. A father can also punish his

children: he may send his son as servant to whomsoever he pleases, disinherit him, and marry his daughter against her will; but he is not allowed to kill them, and infanticide is abhorred.

This authority of the father over his children is maintained only as long as they live with him; after they have left his house he retains only a moral influence over them. In return, a father has the duty of maintaining his family, of defending its honour and interests, and of answering pecuniarily and otherwise for any serious injury or crime committed by any of its members, such as murder, theft, elopement, etc. After the father the next in authority in the family is his eldest son. The mother occupies a very subordinate position. The emblem of family life is the hearth. A good or obedient son is called *ochagsoda* (son of the hearth), whereas an outcast is *beochag* (hearthless).

The hearth is set up in the midst of the room or tent, and is formed of three stones arranged in an equilateral triangle. There are many superstitions concerning the fire, and there is a generally felt reluctance to lend the hearth to neighbours.

Position of Women.—Among the Yezids, as indeed the Kurds in general, the man esteems himself superior to the woman. He certainly takes a mean advantage of his greater strength—passing on to the woman work he could do as well, or better, himself; but, notwithstanding, the situation he creates for her is perhaps better than she occupies among the Tartars and Turks, and even some Christian peoples. His rude life, full of peril, precludes him from treating his wife with much tenderness, but he regards her as a useful companion, capable not only of managing his rudimentary household and rearing his children, but also of tending his cattle and even defending his goods against his numerous enemies. Women learn to ride and handle weapons as well as men, and when attacked in the absence of their husbands they do not hesitate to take up arms against the aggressor. They take care of their cattle and defend it against robbers and wild beasts; they keep watch in the dark night with a gun by their side. A woman showing cowardice is disgraced, and she impairs the reputations of herself and her daughters. Young men in the choice of a wife hold courage in high esteem, as young women appreciate the bravery of the men who are agreeable to them; and thus has been created among this people a type of courageous, dauntless women, who rival men in bravery and intrepidity. This trait is common to both Yezids and Kurds. It is this courage that has won for young girls their independence while unmarried. They are free to choose their friends and lovers among the men, and, far from blaming them for their libertinism, their mothers are often proud of their successes.

With marriage, all is changed. A married woman is bound to remain loyal to her husband, and obey him, under fear of terrible retribution. The faces of the women are far from being repulsive, at least until they grow old, when they become hideous. Young women have usually a small head, regular features, pale complexion, straight and well-formed nose, small and graceful mouth, white teeth, medium-sized brown eyes, auburn hair, and, in general, a sweet expression. They

divide their hair into a number of small, long plaits, which hang down on the shoulders beneath the mantle. Their tresses are ornamented with ribbons and glass beads. The women are clothed in a shirt of the same cut as that of the men, and a large blue tunic tied at the waist with a white cotton or woollen scarf. Like the men they wear on their head a conical felt hat, with a large handkerchief twisted round it, forming a turban. Under this headgear is placed a large piece of white or blue stuff, which envelopes the head and descends over the shoulders down to the belt. Those who do not wear this mantilla wrap round their shoulders a square piece of white stuff and tie it across the breast. Young girls do not wear turbans, but a small blue or red woollen cap ornamented with glass beads. A strip of light-coloured stuff descends from the cap on to the shoulders. The women converse freely with everybody, and do not hide their faces unless stared at too indiscreetly, when they draw a corner of the mantle over the face.

Marriage.—The Yezids are endogamic; they strictly forbid unions between persons of different tribes, and between the secular and religious classes, as also within a certain degree of relationship. Marriage is contracted for life, and is dissolved only in cases of apostasy and adultery. Though not prohibited, the practice of polygamy is restricted to a few *agas* and rich men, who have at most two wives. A man intending to marry must have money or cattle, *kalym*, to purchase a wife. A girl who respects herself will be bought only at a high price, and her parents, unless she be crippled or maimed, regard her as capital to be realised. This capital is not a very large one. In the case of an ordinary layman the *kalym* does not usually exceed thirty sheep or goats, or the price of them. The bridegroom also incurs some other small expenses before he can obtain possession of his wife—for presents to her parents and brothers, and for the *œrekyryn*, the consent of the parents.

When no *kalym* can be raised, and the young people love one another, an elopement takes place. The ambition of the girl consenting to be carried off finds compensation for lack of fortune in the valour her lover must in this case display. For there is no jesting with her parents; they keep a vigilant watch over their daughter, and will not hesitate to pursue, and even kill, her ravisher. A young man, meditating an elopement, must win the support of some courageous and devoted companions, and assure himself of a safe retreat, where he may live undetected for some four weeks. The wrath of a Yezid is prompt but quickly appeased, and he also appreciates courage even when displayed at his own expense. If the ravisher succeeds in hiding his treasure only for a month he may reappear among his tribe, sure of remaining unmolested and of obtaining pardon. "Everything is pardoned to the brave," says a Kurdish proverb. On returning to his occupations the bold man may even enjoy a higher reputation. Nevertheless, elopements seldom occur.

The marriage-ceremonies of the Yezids do not essentially differ from those of the Kurds, and are very simple. Some time after the consent of the bride's parents has been obtained, given always with some pretended reluctance and with a certain solemnity, the kindred of the bridegroom proceed on an appointed day to the house of their future

connection for the betrothal (*daznigary*), where they noisily feast and dance; after that the young couple are allowed to arrange clandestine nocturnal meetings, not, indeed, without the connivance of some matron, who is rewarded with small presents. The wedding takes place later, sometimes a year after, and is performed by a sheikh in the presence of numerous friends and relatives, who dance, play, wrestle, and make great rejoicings on the occasion. In case of the early death of the husband the wife is usually passed on to his younger brother.

The Sheikh's Miridae.—On all occasions when a Yezid wants the assistance of a sheikh or priest he addresses himself to the sheikh he or his family are attached to, though he may dwell at some considerable distance. The flock of a sheikh, though dispersed and not living in a defined parish, constitutes his *miridae* or congregation. The attachment is a personal one, continued probably from the time when there were only nomadic camps gathered around their respective priests or leaders, and no agricultural communities (*gunds*).

Lalish.—The Yezid's Rome, his national and religious centre, is Lalish, where stands the temple of Sheikh Adi. It is situated near Mosul, in a deep, picturesque valley, the slopes of which are covered with dense wood, and at the bottom of which runs a sacred brook. The temple is quite unadorned, and its general appearance is dismal, a dim light penetrating into the interior through only a few windows. It is divided into three parts, a nave with colonnades, and two transepts, where are the tombs of Sheikh Adi and some other saints. On the tomb of the former are inscribed some verses of the Koran, with the object, as is perhaps erroneously asserted, of appeasing the wrath of Mussulmans.

Conclusion.—Our summary study of the Yezids has perhaps been unduly prolonged, and we hasten to conclude. Their social and religious organisation, as described above, is rapidly vanishing, being unsupported by sufficient independence, and vigorously opposed by the laws, institutions, and hostile feeling of the two states between whom the Yezids are divided. The quickest change is certainly taking place among the Yezids inhabiting the Transcaucasian provinces of Russia, which has introduced extensive reforms among them; the Turks are also doing their best, not indeed to reform, but simply to suppress and destroy this people. The great religious and moral reform undertaken in the corrupted Mussulman world by Sheikh Adi and his followers, though not without a certain success, has thus proved in the long-run abortive, like many other similar reforms in both the ancient and modern worlds. The Yezids have themselves done much to hasten their decline by their voluntary ignorance, instruction in reading and writing being a privilege restricted to few among them. They are dying out, but the spectacle of their decay, though sad, has a certain pathetic grandeur. They cling to their ancient chiefs, though their decisions have no longer any legal sanction; they isolate themselves more and more from the outer world, and while they see their number diminishing, they console themselves with the thought that they are Yezd'i—God's chosen.

A FRENCH LADY IN SCOTLAND.[1]

No better account of a Scottish tour has been presented to the reading public than that contributed by Mme. Marie-Anne de Bovet to *Le Tour du Monde* during the past three years. It is not merely gracefully written, but bears evidence of careful study. It is not only graphic in its style, but it is invariably sympathetic in its treatment of the country which was so long the faithful ally of *la belle France*. Besides all this, it is illustrated by a splendid series of engravings, some from original drawings by that admirable artist and *litterateur* Gaston Vuillier, some from well-selected photographs, but all tending to render the publication one of the most attractive which has yet appeared, and one which it is to be hoped will be issued in an English form.

Mme. de Bovet's tour commences with Melrose and the district rendered classic by the residence of Sir Walter Scott. She recounts the history of Melrose Abbey with general accuracy, but errs, in common with most strangers, in attributing its ruined condition to "les fureurs de la Réforme." The fact is that it was the English King Henry VIII., who, enraged at the failure of his "rough wooing" of the youthful Mary Stuart, Queen of Scots, for his son (afterwards Edward VI.), sent, in 1545, Lord Hertford (afterwards Duke of Somerset) with an army (composed of English, Spanish, and Italian soldiers), which laid waste not merely Melrose Abbey, but also the abbeys of Kelso and Dryburgh. A contemporary account of this savage and altogether indefensible raid was discovered by the late Dr. David Laing, and published by him in 1855.[2]

Again, there seems to be no reason why Mme. de Bovet should refer to the Parisian architect of Melrose Abbey as a "Normand sans doute," for the tablet in the south transept, erected by himself, states:—"John Morow sumtym callit was I, and born in Parysse certainly." Whilst the architect's name is spelt both "Morow" and "Morvo" in two contemporary inscriptions on the Abbey, we note that Mme. de Bovet styles him "Jean Morreau," which was probably his original name; for the contention of a recent Scottish writer that "Morow" is a corruption of "Murray" is scarcely tenable. With true French disregard, however, for the spelling of British names, our authoress refers to "Lockardt" as the son-in-law of Scott.

After Melrose and Abbotsford have been explored, Mme. de Bovet proceeds to Edinburgh. She found the New Town to be "very regular, very clean, and very commonplace," but considered the Old Town to be "pittoresque et décorative." Her description of the Castle Rock as "cet énorme bloc de granit noir" is geologically incorrect, however, as the rock is trap. The minute character of her observation is shown by her inquiry into the composition of the Highland regiment which then garrisoned the Castle, and which she found contained more Englishmen

[1] *En Écosse*, par Mme. Marie-Anne de Bovet. *Le Tour du Monde*, 1895-96-97. (Hachette et Cie., Paris.)

[2] *Proc. Soc. Ant. Scot.*, vol. i. p. 271.

and Irishmen than Scotsmen in its ranks. We are glad to think that all our Highland regiments are not open to Mme. de Bovet's sarcastic allusion to "Cockneys enrôlés sous les couleurs des Highlanders."

The White Horse Close and the Cowgate appear to have interested our French visitor much more than Princes Street. Indeed, she says the "White Horse" recalled to her mind the "Albergo dell' Orso" at Rome, where the room once occupied by Montaigne used to be exhibited. The over-zealous sanitary authorities of Rome have, to her regret, demolished that ancient hostelry. But she seems to have been misinformed as to that celebrated Edinburgh man Henry Brougham, Lord Chancellor of Great Britain, and founder of fashionable Cannes. He was not born in the Cowgate, but at 21 St. Andrew Square,[1] and he did not die mad.

Visiting Holyrood Palace, Mme. de Bovet touchingly refers to "la princesse charmante dont le nom est crié par ces pierres." She observes that a bed said to have been used by Charles II. ought not to have been introduced into the audience-chamber of Mary Stuart. "C'est un mauvais tour joué aux visiteurs impressionables, qui sortent trop tôt leur émotion." The bed in question, however (that of Charles I., not Charles II.), was that on which Mary's chivalrous descendant Prince Charles Edward Stuart slept in 1745, so that it has a romance of its own.

On climbing Arthur's Seat, our French lady again found "blocs de granit noir," which ought, of course, to be basalt. She also inspected "Samson's Ribs"; but it was not here but at "The Duke's Walk," to the east of Holyrood, that the gentlemen of Edinburgh were accustomed to decide affairs of honour.[2] Like the ordinary English tourist, our French visitor calls the Calton Hill "Carlton Hill."

Mme. de Bovet criticises with much intelligence the architecture of Rosslyn Chapel, and is of opinion that the design of the famous "'Prentice's Pillar" was probably brought by the master from Rome, as it resembles those marble "cierges pascals" which are seen in several churches there, except that at Rosslyn the stone, "matière plus ingrate," does not lend itself, like marble, to the same delicacy of carving.

Then she proceeds to St. Andrews, describing on her way the Forth Bridge, Dunfermline, Loch Leven, and Falkland. At St. Andrews she devotes herself first to the study of *Golf*, and although she wrongs that manly sport by styling it an "espèce de croquet plus sérieux," she points out its advantages, and chides those of her compatriots who laugh at "la passion de la race anglo-saxonne pour les exercices." After this she describes St. Andrews, "un fantôme de ville," which she says remains the same as it was a century ago, "sauf que les moutons n'y viennent plus paître dans les rues." Everything of architectural interest is passed under review, down to even the Martyrs' Monument, which, however, does not commemorate "les martyrs covenantaires," but four Protestant Reformers, who suffered death by fire at St. Andrews between the years 1528 and 1558.

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[1] See his *Autobiography*. The *Dictionary of National Biography* (1886) makes the same mistake.

[2] *Provincial Antiquities*. By Sir W. Scott (1826), ii. 122.

Again, Mme. de Bovet's strictures on the Covenanters are unfounded so far as the destruction of buildings at St. Andrews is concerned. She says:—"Tous les fanatismes se valent. Seulement quiconque a le goût du beau et le sentiment des vieilles pierres nourrit contre les Covenanters un implacable grief: c'est d'avoir blasphémé l'art et fait œuvre de Visigoths." Now, it was the "rascal multitude," to use the words of John Knox (although a sermon he preached inflamed it), who, in 1559, wrecked the glorious old ecclesiastical buildings of St. Andrews. The "Covenanters" came on the scene long afterwards.

Mme. de Bovet next visited Perth, and on beholding the splendid Tay could not, like Sir Walter Scott, comprehend how the Roman soldiers could compare it to the yellow Tiber. She laments the destruction of the old Parliament House, and the erection on its site of "un abominable temple circulaire pseudo-grec — pourquoi, ô Apollon! sous ce ciel brumeux et mouillé?" in which a museum, library, "et quelques fort méchantes peintures" are lodged. Then she proceeded to Birnam, and was delighted with its scenery and Shaksperean associations. M. Vuillier contributes a fine design of an oak in the "wood of Birnam."

Owing to the illness of the authoress, the publication of *En Écosse* was suspended for several months, and was not re-commenced till May 1896. We find her at Birnam, in the midst of a gathering of local Volunteers, who furnish subjects for some excellent illustrations by M. Vuillier. Mme. de Bovet attended church parade with the Volunteers, but was not impressed with the Presbyterian service. "Prière, hymne, psaume, hymne, psaume, prière, et ainsi de suite jusqu'au sermon." She complains that there is no mystic character about the service, and that to Latins and Roman Catholics like herself, a religious ceremony lacking mystic character is worthless. However, she admits that the Volunteers seemed edified, and were thus of a totally different race from hers. "Their fine faces, all seemingly cut out of the same piece of wood, like heads of pipes, were lit up with an expression of beatitude. A splendid sergeant, with Afghan and Egyptian medals, close shaved, very red, with flaming moustache, seemed illuminated with grace. He looked like one of Cromwell's Ironsides who, covered with the powder and blood of the battle, praised the Lord by paraphrasing the Scriptures before his squadron."

She was introduced to a Volunteer officer, the Marquis of Breadalbane, and lunched at the officers' mess, "avec quarante officiers en jupon," a sufficiently daring thing for a Frenchwoman to do. Placed under the care of an adjutant, she was subsequently accommodated with an easy-chair on the field of inspection, from which she saw the Volunteers inspected by a Major-General from Perth.

"Lord Breadalbane," she remarks, "est le Marquis de Carabas du comté de Perth." "In visiting the district of Loch Tay," she continues, "we find at every step proofs of the interest he takes in the country which the accident of birth has placed under his patronage." Loch Tay seemed to her to possess a "grave and melancholy beauty, with that undefinable charm which pervades Scotland, and which, if it does not carry the heart by assault, insinuates itself gently, and finally

masters it. Between the scarped and wooded hills which surround the loch, we observe those narrow, deep, solitary valleys, always the same and yet always differing, like the sea, those *glens* which constitute the characteristic feature of Scotland."

Our authoress was much pleased with Taymouth Castle, which she informs us is built of a remarkable stone, "as soft as butter in the quarry, and which the atmosphere hardens to the solidity of granite." An adventure with her hotel-keeper at Dunkeld makes her remark that Scotland could give Switzerland hints as how best to fleece tourists. However, she, a Parisienne, proved too much for this Scotsman; and she takes credit for avenging in person the many complaints tourists make against the "exploiteurs de cet immense caravansérail qu'est le royaume de Robert Bruce."

As she goes along, Mme. de Bovet disabuses her compatriots' minds of errors and prejudices into which they had fallen. For example, she says that the majority of French people imagine that the hereditary nobility of the United Kingdom exercise feudal privileges of an extraordinary character, whereas, beyond sitting in the House of Lords, British Peers enjoy no greater privileges than do their own farm-tenants. Again, she explodes the idea that the climate of Scotland is never warm, for she found the heat at Birnam excessive, and pitied the Volunteers manœuvring under such a grilling sun.

Our French lady was bored with the information gratuitously communicated by the drivers of the Highland public coaches. One of them mentioned the names and heights of all the mountains which they saw, a practice on which she comments: "What does it add to the wild poetry of those blue and violet lines to be told that they are called Cairn Gorm, or Cairn Bannoch, Ben Mheadain, or Ben Muich Dhui, and so on, names forgotten as soon as heard, and unintelligible even to the English themselves?" At the same time, Mme. de Bovet pays a high compliment to the English tourists whom she met in Scotland, when she says that the disagreeable qualities with which her compatriots often credit them were entirely absent, and that she found nothing but "obligeance, bonne grace, et sociabilité de la part de tous ces inconnus frôlés au hasard de la rencontre."

From Dunkeld she drove to Braemar, which she contrasts with Continental health resorts. "Instead of drinking malodorous water as a pretext for curing vague illnesses, we breathe here, what is much better, air of a remarkable quality, impregnated with the scent of forests of pines, whilst we live sheltered by lofty mountains from high winds from the west and north. We gain strength here in the midst of delicious peace." Then she proceeded to Ballater, passing Balmoral, which, however, she did not enter although armed with authority from the Lord Chamberlain, for she did not think it possessed the interest of many small country-houses rich in the souvenirs of centuries. Again we must congratulate M. Vuillier upon his fine sketches entitled "Lochnagar" and the "Mountain of Mist."

By Pitlochry, Killiecrankie, and Blair-Atholl, Mme. de Bovet journeyed to Inverness, admiring as she went the "vast undulating plateaus,

carpeted with heather and broom, bilberry and myrtle, ravaged by torrents, and absolutely deserted except for scattered flocks, and here and there stations apparently of little use, the line crossing successive mountains whose colouring, at once powerful and soft, passes from the deepest purple to the faintest violet, with glimpses of wild lochs and desolate glens." Scenes such as these, worthy of Turner and Doré, have been the despair of artists, and she thinks that the Scottish painters have succeeded best, so much does the peculiarly strange character of these Scottish scenes demand protracted admiration and study.

Culloden and its associations naturally fill a good many pages of our French lady's journal; but in arguing that, as Prince Charlie's rebellion was a "Scottish war of independence," Scottish Presbyterians willingly supported a Popish prince, she forgets that the majority of Scotsmen, and most of the Presbyterians, were on the side of King George. However, she considers that Scotland, by committing to oblivion the atrocities then perpetrated by English soldiers, furnished to Ireland a splendid example of common-sense and political wisdom.

Most tourists go no farther north than Inverness, but our enterprising traveller wanted to see the full length of Scotland, so pushed on to Thurso, and from thence sailed to Orkney, where she declares she already felt the mysterious attraction of the Boreal regions. M. Vuillier, assisted by the engraver Devos, here furnishes some admirable illustrations, a full-page one representing the "Old Man of Hoy." Catching the Leith steamer at Kirkwall, Mme. de Bovet had a stormy voyage to Lerwick. Has ever Parisienne visited "Ultima Thule" before? Even Scottish tourists seldom penetrate so far.

Our visitor being a Roman Catholic, she probably regarded with only superficial interest the many religious sects in Scotland, but her description of the churches in Lerwick is amusing. "Lerwick possesses seven churches for 4000 souls.—Established Presbyterians (Church of Scotland); United Presbyterians, so named because they disunited themselves from the others; Free Presbyterians; Episcopalians (Church of England); Wesleyan Methodists; Congregationalists; and Baptists."

Returning to the mainland, she visited Wick, which she found "very dirty, and reeking of tar and the seashore." She then travelled by rail to Strome Ferry, and sailed to Portree. A series of remarkable sketches of the scenery and natives of the Isle of Skye is contributed by M. Vuillier, whose representation of cloud effects is particularly fine. Our indefatigable lady "did" all the sights of Skye, and, after sailing across to the Gareloch, exclaims: "How delightful to sail during a calm evening over a smooth sea on which the mysterious blue light of nightfall casts its pearly reflections—a sea which, slumbering peacefully amid all these headlands, seems almost to be a lagoon."

Hard as, she says, Scottish beds are, she declares that harder still was rising at 5.30 to catch the steamer from Inverness along the Caledonian Canal, the great fault of which voyage was the wind, which rushes down the Great Glen and necessitates wearing "that woollen cap which in Scotland has no sex, the *Tam o' Shanter*." Ben Nevis did not appeal to her sense of picturesqueness. "Crowned by neither

peak nor pinnacles, it resembles a gigantic plum-pudding irregularly kneaded."

She considered Oban particularly favourable for the development of the microbe of travel. "Several steamers lie at the bustling quay, which is really lazy, and only active in appearance, whilst a beautifully white and clean city of pleasure occupies an amphitheatre formed by a rugged and verdant cliff. A superfluity of caravansaries, more or less elegant, stretch, like a row of onions, along the shore, whilst on a height is the lugubrious skeleton of a Hydropathic which, Heaven be thanked! remains unfinished for want of funds."

Of course, Mme. de Bovet visited and moralised over Glencoe, out of which, she says, Macaulay and all the Whig historians will never be able to wash the stain of blood. M. Vuillier contributes several splendid sky scenes, besides a fine sketch of Fingal's Cave, which our traveller next visited, passing the Island of Mull, where she observed several "modern and most magnificent castles, built in the feudal style, and among them that of the great publisher Black, of Edinburgh." She is, however, mistaken as to the name of the proprietor.

Arrived in Iona, she muses on its past history, and on its celebrated saint Columba, remarking: "The year Columba died was that in which the monk Augustine, coming from Rome, landed at Canterbury in order to convert the Saxons of the Heptarchy. The Church was already established in Ireland and Scotland upon a purely national basis. Is it not from this circumstance that the passion for religious independence was derived by the Scots? When Catholics, they submitted to the Pope's authority only so far as not to lapse into schism. When Protestants, they freely shed their blood to emancipate themselves from the supremacy of the English Church. Even Irish Papists are inclined to show themselves rebellious children, when the intervention of Papal authority as regards their politics is not to their minds." She might have added that the Christian Church in Wales was also pre-Augustinian.

From Oban she sailed to Glasgow, and she reproves those who leave the steamer at Greenock and do not sail up to the Western metropolis. "However little we may have to do with industry, the sail up the Clyde is full of interest. There we feel the throbbing of the pulse of that other Scotland, Lowland Scotland, manufacturing and commercial, and above all that of Great Britain, the Queen of the seas. The banks of the Clyde, as we all know, are the great European centre of shipbuilding. The annual tonnage of vessels launched there averages from 380,000 to 400,000 tons per annum, and comprises huge Transatlantic iron steamers, besides those for the Pacific and Indian oceans, and Chinese and Australasian seas, down to light wooden pleasure-yachts. Of course this industry has its occasional crisis, that eternal crisis which appears everywhere and renders prosperity insecure."

Our Glasgow readers will be amused with Mme. de Bovet's comments upon them. She says that the "speciality of Glasgow is that it contains the most religious population in Scotland, and that is saying a a good deal! Do you know how many churches there are in Glasgow—not those traditional Roman churches which are rather monuments of

art than places of worship—but churches in vogue, churches in use, each, except the Cathedral, uglier than the other, in keeping with the morose spirit of Puritanism? There are three hundred and forty-six belonging to different denominations."

Our visitor makes a *faux pas* when she declares that the city of Glasgow is so great that it despises administrative honours, and that the capital of its county is "the Royal Burgh of Renfrew, on the Clyde, which gives the Prince of Wales the title of Baron."

But she correctly remarks that "Glasgow presents this curious feature that, although a Lowland city, it is largely populated by Highland immigrants. In 1605 it contained only six 'Macs.' Now they represent a tenth of the population."

She designates the Cathedral "the only artistic monument in Glasgow, and one which fortunately escaped the destructive frenzy of the Reformation. Not that the citizens of Glasgow were suspected of Popery, but they were wisely conservative, and loved their old St. Mungo."

"If the artisan districts of Glasgow are lamentable, those of the better classes are terribly dull." She is particularly severe in her criticism of the statue of Sir Walter Scott in George Square, and as to the equestrian one of the Queen, she declares it is an "abomination committed by an Italian whom, out of charity, she will not name."

A trip to Loch Lomond and the Trossachs completed Mme. de Bovet's visit to Scotland. She was charmed with the picturesqueness of the scenery, and closes her graphic account of our country with the following word-picture. "Wonderful is that view from Stirling Castle over the rich plain, green with meadows, golden with corn, which stretches to the horizon darkened by the blue mountains of the Highlands, and through which flows now in curves, now in rings, now in infinitely twining links, the silvery Forth, the most capricious of streams. The sky was delightfully clear, the sun was gloriously warm, the atmosphere was exquisitely pure, although enveloped like a caress by some luminous vapour—it was, I say, a magnificent day when I bade a never-to-be-forgotten farewell to the lovely, the noble, the romantic soil of Scotland. In leaving it, I should reproach myself for having said too much, if I did not regret the omission of much which I had to say. I ask pardon both for my sins of commission and omission."

Thus ends one of the most attractive accounts of a tour through Scotland ever published. Always graceful, and nearly always just, the criticisms of Mme. de Bovet should be welcomed by the Scottish people, if only to confirm the lines of their national poet:—

"O wad some Power the giftie gie us
To see oursels as ithers see us!
It wad frae monie a blunder free us,
And foolish notion."

RALPH RICHARDSON.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

On Tuesday, May 17th, Mr. Harry de Windt lectured in Edinburgh on his journey "Through the Gold-Fields of Alaska to Bering Straits." His lecture, abounding in thrilling incidents, was much appreciated by a large audience. He described the crossing of the dangerous Chilkoot pass to Klondike, gave some details on the mining in that region, and concluded with a sketch of his sojourn among the barbarous Chukchis of Siberia. Dr. George Smith presided.

The season was brought to an end on Thursday, May 26th, by a lecture in Edinburgh by Major Stanley Paterson, of the Argyll and Sutherland Highlanders, who during last winter ascended the Cuchivero river, a tributary of the Orinoco, in the hope of reaching Mt. Icutu, and made other explorations in the Orinoco basin. The Chair was taken by General Sir R. Murdoch Smith.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Geography at the University of Vienna.—Professor Penck's *Report* on the geographical work of the Vienna University sets before us a state of things that all advocates of geographical education in this country must envy. Ever since the foundation of the University in 1365, lectures on geographical subjects have been delivered, but no special professor was appointed until, through the influence of Count Leo Thun, the University was reorganised on the model of the German. In 1851 Friedrich Simony, who had already distinguished himself by his examination of the glaciers and lakes of the Salzkammergut, was appointed to the Chair. He regarded geography, as it should be taught in the University, as a scientific exposition of the natural features of the earth, with special reference to the physical characteristics of the Austrian Empire. But at the same time geography in the intermediate schools was associated in the curriculum with history, and consequently the two subjects were combined in the teachers' examination. Simony's audience was therefore composed principally of historical students, for whom he had to adapt his lectures, and he was thus prevented from treating his subject from his own point of view. He did, however, establish a geographical collection in connection with his Chair.

When Simony retired from his post in 1885, it was resolved, chiefly at his suggestion, to remove as far as possible this restriction by the appointment of two professors, a measure which was also advisable in view of the enormous expansion of the science of the Earth during the present century. Accordingly two professors were appointed, one for physical geography and one for historical, the limits of their spheres, which often approach one another very closely, being left for the professors themselves to determine. By mutual agreement Dr. Wilhelm Tomaschek devotes himself chiefly to the geography of the old civilised countries, the Mediterranean Sea and the Indian Ocean, while Dr. Penck undertakes Austria-Hungary and the rest of Central Europe, as well as Western Europe. Besides this, Dr. Tomaschek

lectures on historical geography in general, and Dr. Penck on the knowledge of the Earth as a whole.

The above subjects occupy the time of the professors so fully that little is left for the geography of foreign countries; this want is now supplied by Dr. Sieger. A three years' cycle of lectures is now established, and, besides these, students enjoy the advantages of laboratory work, excursions, encouragement and advice in original work (some of which is published in the *Abhandlungen*), etc., for the particulars of which we must refer the reader to Dr. Penck's report.

Geography has long been a subject which may be taken for examination for the diploma of doctor. Formerly, as the secondary subject, only History or Archæology, Physics or Astronomy, could be taken, but now a greater choice is allowed, and the number of candidates who take up Geography for their degree has been increased; Geology, Meteorology, or History is usually the extra subject. In the examinations for teachers in the *Gymnasia* Geography is connected with History as a principal subject, while for the *Realschulen* it is only an extra subject. These examinations have a certain connection with the University, as the examiners are chosen from among the professors.

Upper Albania.—Dr. Kurt Hassert, whose journey in Upper Albania was mentioned in vol. xiii. p. 606, gave a full account of his observations before the Berlin Geographical Society in December last (*Verhandl.* Bd. xxiv. No. 10). After a long delay, owing to the Greco-Turkish war, he landed with Dr. Antonio Baldacci at San Giovanni di Medua early in June, and having got his instruments and baggage safely through the custom-house, he rode past the town of Alessio into the Drin plain, on his way to Scutari. The devastations caused by floods were everywhere visible; and this basin which, under better management, might be converted into a splendid granary, is a fever-haunted marsh. Consequently the inhabitants resort at the beginning of summer with their herds to the breezy uplands.

The fruitful plain of Scutari is surrounded by high mountains, and encloses a lake swarming with fish, and navigable by small steamers. Situated on a lake affording means of communication with the most fertile districts of Montenegro, and connected with the sea by the navigable Bojana river, with an easy route for a railway to the coast, the town of Scutari, which contains over 30,000 inhabitants, might be a flourishing commercial centre were it not under Turkish rule. As it is, trade and industry are at a low ebb, and only the products of a very restricted home industry are offered for sale in the shops. In appearance the town is strictly Turkish, with narrow irregular streets, badly lighted.

Travelling in Upper Albania is much more difficult than in Montenegro. The Turkish authorities put every hindrance in the way; there are no good roads; and the inhabitants of the mountains, the Malissores, over whom the Government has no control, are a barbarous people, in perpetual feud among themselves or with the Montenegrins, or revolting against the Turks, and seem to consider robbery, murder and war as the business of life. The greater part of the interior is occupied by the ramifications of the Dinaric mountains, an entangled network of deep valleys and lofty narrow ridges, interrupted by only a few high passes, two or more of which were often crossed by Dr. Hassert and his party in a single day.

The first long excursion made by Dr. Hassert was to the Zukali mountains. A ride of several hours over a heath, with but few cultivated fields, brought him to a side-valley of the Kiri, lying on coloured sandstone and clothed with forest, of chestnuts and oaks in its lower part, and beeches farther up. Having crossed a small ridge, the party encamped in a clearing, and started in the morning with the thermometer at 43° F. to climb the Maja Malesife, a peak rising not much above the

forest limit. Here, as well as from the Mali Zukalit, 6038 feet high, they enjoyed a fine view over the mountains of Southern Albania and the Northern Albanian Alps just in front of them. An ascent of the Maranaj, 5170 feet, was rendered unpleasant by heavy rain; and then, returning to Scutari, the party started on a long journey through the Mirdita country to Prizren. This Catholic tribe of the Malissores dwell beyond the Drin, and have extorted numerous privileges from the Porte. They are quite independent, and suffer no Turk to come among them. In war they follow the colours, and have the right to fight on the right wing of the Turkish army. Thanks to the care of the Arch-Abbot of Orosi, the chief town of the country, Dr. Hassert succeeded in passing through unmolested, and fortunately meeting with no mishap in the unsettled Ljumese territory, arrived safely at Prizren.

This town is picturesquely situated at the northern foot of the Šar, rising up from a hollow surrounded by mountains. The upper town looks down on the lower town with its twenty-five minarets, and over the plain to the fields of Ipek and Jakova. It is commanded by a large fort, behind which again rise the ruins of the White Castle of Prizren. In spite of its irregular lanes and unpretending houses, Prizren is one of the richest industrial towns of the Orient. It has waterworks, and its inhabitants are skilled in the manufacture of weapons, leather goods, etc. Unfortunately the robberies of the Ljumese have considerably injured the trade, and the traffic has fallen off since the opening of the Macedonian railways. The inhabitants of the town, thirty-six to forty thousand, are Servians, Albanians, and Vlachs, in religion Greek, Roman Catholic, and Mohammedan. The Christians are fanatical and zealous in the outward forms of their religion, but are grossly superstitious. The return to Scutari was made along the usual trade-route, a considerable section of which is nothing but a wretched bridle-path beside the Drin.

Dr. Hassert also made an excursion northwards into the Šala valley, a wild country, where his party was attacked by robbers, fortunately without serious consequences. The scenery in these northern mountains is very different from that in other parts of Albania. There the colouring is dark owing to the preponderance of slates, and the hills are clothed with forest and meadow-grass nearly to their summits. But here limestone is the common rock, and the Karst formation is fully developed. The steep ridges rise far above the forest limit. Of the fifty most prominent peaks and pinnacles, some are at least over 9800 feet high. The people are poverty-stricken, dirty, and lawless. The vendetta is the greatest curse of the country. In Albania 3000 persons fall victims annually to this savage custom, and in Upper Albania the deaths due to this cause form 25 per cent. of the total. The activity of the men is greatly impeded, and consequently the women have to do the work of the family, till the fields, and go to market.

The last excursion made by Drs. Hassert and Baldacci was westward into the country south of the Scutari lake. Crossing the frontier of Montenegro at Ostros, they entered a series of Karst basins leading to the broad hollow of Livari. From this town they climbed the Rumija, a mountain 5225 feet high.

ASIA.

Wei-hai-wei.—Thirty miles to the west of Shantung promontory the flat and marshy coast is suddenly interrupted by a hilly peninsula, three miles long by about five broad, jutting out into the sea from the heights of Hai-shai-in-gan-su. This elevation is the eastern horn of a large crescent, which confines, on the south, a large plain six miles long by three and a half wide, and extends on the west to Cape Cod. The spacious roadstead thus formed is separated from the open sea by the conical

island of Liu-kung-tau, flanked on the west by the Observatory island, or Hwang-tau, and on the east by the island of Ni-tau. The town of Wei-hai-wei is situated just at the base of the peninsula of Cape Cod, in a triangular valley so short that the buildings in the north-western quarter extend up the hillside on terraces supported by walls. As there is no room for the arsenal here, nor a practicable site on the dune of moving sand along the shore, it has been placed on the southern side of Liu-kung, separated from the coast by an elliptical basin three and a half miles broad. The basin is connected with the sea on the side of Hai-shai-in-gan-su by a passage fully three miles broad, called the Great or East passage, and on the side of Cape Cod by the Little or West passage.

The territory, as originally ceded temporarily to the Japanese, includes, besides the bay and its islands, a belt of country along the shore twelve miles broad, and it was stipulated that no Chinese troops should approach the occupied territory within a distance of twelve miles. The country included in the first zone is exceedingly fertile and densely peopled. The plain of Wei-hai-wei is particularly rich, and might soon be converted into a highly productive garden ; it contains seventeen large villages. Chi-fu is not far distant, and a railway to this port might be afterwards prolonged to the rich valley of the Hwang-ho.—*A Travers le Monde*, April 23rd.

MM. Roborovski and Kozlof in Central Asia.—Last November the Russian explorer read a preliminary report of his expedition in 1893-95, before the Imperial Russian Geographical Society, and he has forwarded a copy to the Society. The discoveries of Captain Roborovski, as well as of M. Kozlof, who made several independent excursions, have been fairly fully recorded in the *Magazine* (see vol. x. p. 540 and vol. xi. pp. 138 and 311), at least up to the time of their first departure from Sa-chau. Some additional details may, however, be of interest. Thus, it is curious that the Torgouts of the Yuldus, who once dwelt on the Volga (vol. x. p. 541), still dream of returning one day to their original home, and carefully preserve the deed by which the Empress Catherine secured to them their lands on the river. The Little Yuldus is watered by the Baga-Yuldus-gol, which flows into the Khaidyk-gol, and the united streams make their way through a gorge 2500 feet deep into a broad, desolate valley, where they are joined by the Tsagan-usu flowing down from the snowy mountains on the north. Here was found an ancient wall carried across the valley so as to bar the road to the Dalyn-daban. Built of large cobbles, it extends for a distance of more than five miles from north to south, but is now fallen into decay. It was constructed as a protection against the Dungans, who lived here fully 300 years ago, by the Mongolian khan Makur-Khan-Taiji. Farther east the river flows into the Bagrash-kul, and finally enters the Konche-daria branch of the Tarim river.

Captain Roborovski reached the Algo river by crossing the Tashagain-daban pass, about 9000 feet high, and descended to Toksun, 98 feet above sea-level, where they found a telegraph line fallen into neglect. From Sa-chau it runs to Khami, where it branches into two lines, one to Urumchi and Kulja, the other to Karashar and Kashgar. Having established a meteorological station at Liukchun, 16 feet above sea-level, Captain Roborovski proceeded to survey the depression. His statement of the level of the salt lake Bojaite in the lowest, south-eastern part of the hollow, for which so many figures have been given, may be taken as final ; it is 328 feet below sea-level.

In March Captain Roborovski visited the Kala-chi or Kara-nor from Sa-chau, and made a journey of over 160 miles, there and back, to the Altyn-tagh, an

account of which was given in vol. xi. p. 138, while Kozlof visited the town of Yui-myn-sian. The expedition then set out for the Nan-shan, taking the Shara-goljin, as the upper course of the river Dan-ho is called, as their line of advance. Having made halts for the purpose of increasing their collections, they marched southwards up the Kuku-usu, which runs for six miles in a rocky gorge, bestrewn with granite blocks, leading to a valley where one of Przhevalski's men was lost in 1879. From the ice-covered Humboldt range on the east several streams descend to the Kuku-usu; on the south of the valley a range branching off from this glacial mass proceeds west-north-west to the snowy peaks of the cloud-capped Amembar-ula. Following the valley eastwards, the expedition passed the southern range, Kuku-usynyn-daban, by a pass 13,406 feet above sea-level. On the southern side lay a belt of snow ten feet deep, which the animals were able to cross, thanks to the severe cold (7° F.). From the pass could be seen the Syrtyn valley, partly covered with sand interspersed with swampy patches, and partly consisting of pebbly, clayey tracts; beyond, to the south, rose the Dakhyn-daban, a western prolongation of the Ritter chain, which, though not lofty, was partially clothed with snow; while to the east stretched the mighty snow-fields of the Ritter and Tsagan-obo mountains, and westward the faint outline of the Amembar-ula.

Between the Humboldt and Tsagan-ula the river Ikhe-Khaltyn-gol traverses a passage twenty-six miles long, and emerges into the Syrtyn valley, where it makes for the lakes, but after a course of twenty-six miles hides its waters underground, sending them out again in numerous springs at Toda. Captain Roborovski leaving the river marched south-westwards, and passing round the western extremity of the Dakhyn-daban, turned east-south-east to the Keptu-daban pass, about 12,000 feet, connecting this range with the Orogyn-gol-daban, and came to the snowy groups of Beljin-ula, Bomyn-ula, Tsaidamin-ula, and Khaktyn-ula on the south, whence, forty miles east of the pass, descends the Bomyn-gol. Then, turning sharply to the north, he crossed the Ikhe-daban by three lofty passes, the Ritter chain forming an inaccessible wall to the west, and reached the river Ikhe-Khaltyn, between the Humboldt range and the Ikhe-daban, and by the Ulan-daban pass, 14,351 feet, crossed the Humboldt range and returned to his camp in the Kuku-usu valley, where he was joined by Kozlof, who had visited the salt lake Dzeren-nor, and crossed the Yema-ho valley to the Tulete-daban, 13,500 feet, and by the Shara-goljin regained the camp.

To describe in detail the various excursions made by the two explorers would demand too much space. Captain Roborovski ascended the Baga-Khaltyn-gol, and by the pass Turghyn-daban, 15,866 feet, covered with snow and glaciers, crossed the Ritter range and returned over the Shirin-Khutul, 16,007 feet, to the Kara-Kulusu, a tributary of the Great Khaltyn. Thence he continued his journey across the Humboldt range by the Kara-daban, 15,387 feet, where yaks were seen living undisturbed by man. On another excursion he crossed the Humboldt range by the Keptul-daban, 14,660 feet, descending to the Ikhe-Khaltyn-gol, which he followed to its source in the Yanke-daban, and over the eastern end of the Ritter chain, 15,673 feet high, reached the Baighyn-gol flowing out of the South Kuku-nor mountains to the Kurlyk lake. Up this valley, where many Mongol shepherds live, he came to the source of the river at the Ulan-Khutula pass, 14,220 feet high, the watershed whence the Bain-gol flows eastward. The Ara-gol, a tributary of the Bain, was reached by the Kuku-boguchi pass, 13,855 feet, and by another pass, 15,102 feet, the Noiin-Khutul, the basin of the Bukhain. At the head of the river, the Tzairmyk-daban, 14,600 feet, between the Tzairmyk-ulu and the Sharagolin-Namdzil, a sacred mountain of the Tanguts and Mongols, leads to the Suloi-ho, and thence by the western Tzairmyk-daban pass, 15,325 feet, to the valley of the

Kara-nor lying 13,000 feet above sea-level. This lake, never before visited by Europeans, is about forty-six miles in circumference, and has slightly saline water. On the southern slope of the Tzairmyk-ula a small salt lake, Nogon-nor, was discovered at a height of 13,891 feet.

Kozlof also visited the Kara-nor, on his way to the Suloi-ho, which he traced upwards for sixty-six miles; it descends between the Emperor Alexander III. and Surin-ula ranges. The latter attains a considerable height at its eastern end and feeds the Bukhain on the south, and the Tetung on the east. From the Tetung Kozlof crossed the Sharagolin-Namdzil by a pass 13,000 feet high to the Bukhain basin, and over the Bukha-daban regained the Kara-nor.

The Bukhain, flowing through rich meadows where large numbers of wild asses, yaks, and gazelles (*G. Przhevalski*) feed, runs into the Kuku-nor, 10,499 feet above sea-level. Thence the expedition crossed the south Kuku-nor range to the Tsagan-nor, a small lake 10,633 feet high, near which is the Dulan-kit temple visited by Przhevalski. Then the Dulan-nor and Syrho-nor were passed and the sources of the Ara-gol were reached.

Two months were spent at Kurlyk, and then the expedition marched past the Kurlyk-nor and Tosso-nor to the valley of the Baran-gol, flowing in a fruitful valley. Issuing from the Tosso-nor (another Tosso-nor to the south-east) the river is known as long as it is in the mountains as the Egrai-gol; after it emerges from the mountains it runs underground for a distance of twenty miles and on its reappearance forms a voluminous stream. The Tosso-nor lies among mountains at a height of 13,238 feet, and has a length of twenty miles and a breadth of four and a half to six and a half. Still farther east the Kara-nor (the third Kara or Khara-nor mentioned in this paper) lies among desolate rugged mountains at a height of 13,094 feet; it is nine and a half miles in circumference. Travelling southwards the expedition reached the Churmyn river and the range Amne-machin, which running south-east from the Burkhan-Budda attains heights of over 25,000 feet and forces the Yellow river to make a long detour, and after a night of danger among the Tanguts returned to the Tosso-nor, and thence to Kurlyk. Their route westwards was the one Przhevalski followed past the salt lakes, Baga-Tsaidam and Ikhe-Tsaidam-nor. From the southern side of Kurlyk-nor the Khabirghin-ula runs north-westwards for forty-five miles, and from the south of Tosso-nor the Imyken-ula runs in the same direction, separating the northern Tsaidam from the southern. Under various names these mountains extend as far as the meridian of Makhaia, where they merge in the Orogyn-ula or Syrtyn-Makhain-ula, which sixty miles farther terminates in the desert on the eastern shore of the Khuitun-nor. Crossing the Orogyn-ula by a pass 12,000 feet high, the expedition reached the Syrtyn and at length found its way back to Sa-chau.

Here ends the most interesting part of Captain Roborovski's narrative of which the above is a very meagre summary. The results of the expedition are of the highest value; not only has much new geographical information been acquired during journeys extending over some 10,600 miles, but large zoological and botanical collections have been brought home, as well as meteorological records.

In another pamphlet M. Kozlof deals with Lob-nor, and having reproduced the descriptions of Chinese historians and geographers, the reports of Russian travellers, and his own observations in 1894, he comes to the conclusion that the theory propounded by Dr. Sven Hedin (*see* vol. xii. p. 643) must be rejected. Kara-Koshun-Kul is, he says, not only the Lob-nor of Przhevalski, but also of the old Chinese geographers. Undoubtedly in old times the lake extended much farther north, while the west boundary ran through Urten, Ablain, and Aryglan, but the southern shore is just where it was when Marco Polo saw it 600 years ago.

AFRICA.

The High Plateaus and Steppes of Algeria.—It is usual to divide Algeria and Tunis into three zones, the Tell, the high plateaus, and the Sahara. This division Professor Augustin Bernard condemns. The natives, he says, distinguish only the Tell and the Sahara, the names relating only to forms of relief. He himself uses the term Tell for the region cultivated or capable of cultivation, while the Sahara is in general barren. Between the two occur what should strictly be called steppes. As the terms applied to certain forms of elevated land have been used very loosely, Professor Bernard defines (1) highlands (*haute-terre*), as a region of considerable mean altitude; (2) platform, as a country where the strata are horizontal without folds; (3) elevated plain, as a level surface produced by the filling up of depressions with alluvium; and (4) plateau, as a plain due to erosion and abrasion which have removed the inequalities.

The chains of Algeria and Tunis have no connection with those of Morocco, as has often been stated, but are of later date. The relief is formed by two series of folds, the Tell Atlas and the Saharan Atlas. The calcareous chains were raised chiefly in Tertiary times (Miocene), and have been forced by lateral compression against the older rocks, of which some traces are yet to be seen on the coast, particularly in eastern Algeria. At many points between these folds occur elevated plains, formed of Quaternary and recent alluvium washed down from the surrounding mountains. They show that North Africa has passed through periods of great humidity, followed by periods of drought. Had the humidity continued, the streams would probably have found their way eventually to the sea. These elevated plains occur between the Atlas and Middle Atlas in the Dahra of Morocco, are continued in the plains of Oran, with an altitude of 3300 to 3900 feet, gradually change their character in the region of the Zahrez, where they are intersected by more numerous ridges, and, diminishing in elevation, terminate at the basin of the Hodna, only 1300 feet above sea-level. There are numerous other smaller plains, and even in central Tunis some are to be found; but here the waters have succeeded in making their way towards the sea through the Medjerda basin, and the rainfall is heavier. There are, then, in this country no true plateaus, such as the Spanish *meseta* or the central plateau of France. The whole surface is covered by a series of mountainous folds running east and west, between which lie elevated plains, extending in the same direction, but not forming an uninterrupted succession.

Steppes are lands where the water supply is insufficient to maintain forest vegetation. The soil produces only bulbous plants and grasses, which die down in the dry season. Steppes, then, occupy an intermediate position between cultivable lands and deserts, and are, like the latter, the result of the climate. In north Africa they may be said to be the regions where the mean annual rainfall ranges from 6 to 12 inches. With a fall of less than 6 inches the country is a desert, while with more than 12 it can be cultivated. The steppes, then, are the land of sheep-feeding. The principal plant is esparto grass, though considerable tracts are covered with other kinds of vegetation. As the rainfall diminishes with the distance from the sea, we expect to find a zone of steppes extending east and west through Algeria and Tunis, between the Tell and the Sahara. They may easily be confounded with the elevated plains, because the latter favour the development of steppes when shut in by mountains, or, at least, sheltered from the moist winds. Nevertheless, the elevated plains and steppes are by no means identical, for many circumstances regulate the rainfall in North Africa. Distance from the sea is only the chief factor; the fall increases from west to east, and Eastern Tunis, bathed by the sea, is influenced by special conditions. In a subordinate degree the composition of the

soil and the depth of vegetable earth also contribute to the result. The climatic conditions of the steppe may accordingly be found elsewhere than on high plateaus, while some high plateaus may remain capable of cultivation. At the edge of the Sahara the steppe stretches up the sides of the mountains, in some places extending over the summits. The elevated plain of Sétif and the patches of high lands in central Tunis are excellent for wheat, while the plain of Chélif does not every year receive rain enough to produce crops, and is almost a steppe. Farther east the plains of Angad and Trifa, the desert of Garet, allow the vegetation of the Sahara to advance to the coast.—*Bull. de la Soc. de Géographie d'Oran*, Trim. 1, 1898.

The Namuli Peaks.—In *Life and Work in British Central Africa* for Aug.-Dec. 1897, kindly sent to us by Mr. R. S. Hynde, Mr. James Reid, of the Blantyre Mission, describes a journey from Nyasaland to these mountains. Mr. Henry O'Neill was the first to reveal their existence, and subsequently they were visited by Mr. J. T. Last. They lie between Lake Shirwa and the Mozambique coast, about 170 to 200 miles east-north-east of Blantyre. Some years ago the writer, in the company of the late Dr. Affleck Scott, endeavoured to reach the hill, but was unable to get nearer than Masisi, some twenty miles to the south-west of Namuli.

Mr. Reid's party crossed the Shirwa plain, a huge marsh in the wet season, but then baked hard under a fierce sun, finding neither water nor shade till they reached the Sombani river at Nkolonje hill. Rising in the Limbi marsh at the back of Mausi hill, the river flows into Shirwa lake. It abounds in fish, and the country at the south end of the lake is well known to sportsmen, who find there hippo, gnu, zebra, waterbuck, and antelopes of all kinds. From Ntemanyama's village Mr. Reid marched north-east, and passed through a gap in the Mpwesi hills to the East Shirwa plain. Running almost parallel with the lake at a distance of some ten to fifteen miles is a range to which O'Neill gave the name, for want of a better, of Luasi hills, the Luasi being a tributary of the Luli that rises among them. The East Shirwa plain is thinly forested, and the soil is hardly rich enough to support the villagers. Past Pweremwe's village, dirtier than most of those of the Manganja tribe, where salt is extracted from the soil by filtration and evaporation, the party crossed the boundary into Portuguese territory, and, having visited a mission station, came to the Mlumbu hill, the east side of which reminded Mr. Reid of Salisbury Crags. As seen from a gap in the hill, its form is that of a horse-shoe. The flanks are fairly well-wooded. In the distance, over a well-wooded plain, were seen the hills of Che Sumbu, where the Yao chiefs, Mataka and Sekula, live, while immediately below was the source of the Luli. Proceeding east-south-east past a huge cupola of hoary granite, 300 feet or more in height, near Pekuni, and crossing the watershed, they entered a more fertile and better watered country, and came to a halt at the village of Nangumi. After an hour's walk in a north-easterly direction the Peaks came into sight, lying far to the north, while the Masisi and other smaller hills were distinctly seen. The country is densely peopled. Many of the villages are surrounded by thick *bomas*, the entrances being sometimes in the form of a tunnel 14 to 16 feet long. Iron-working is an important industry. Potatoes, tobacco, tomatoes, and field crops grow luxuriously, and fowls, ducks, and goats are abundant. The Lu (or Ulu) river, which rises among the hills on the west side of Masisi, was crossed ; it was fully 50 to 60 yards broad, and had a fair supply of water, considering it was the middle of the dry season. Next, the Lukugu river, in the Lomwe country, was crossed, a stream 70 to 80 yards broad and 18 feet deep, which must in the wet season be nearly impassable.

At length Mr. Reid reached Nguruwe's village, from which he made an excursion to the Namuli hill, reaching a gap on the west side of the Mprise peak after a

stiff, unbroken climb of 2000 feet. The view from this height is much grander and more impressive than that from Zomba or Mlanje. The mountain runs in the form of a horse-shoe from east to west, and a series of small ridges run down southwards from the main crest to a central valley, down which the Malema river flows. On the north and north-east hills rise tier upon tier till they are lost in the distance. The scenery on the banks of the streams defies description, especially on the Malema, which tumbles over huge boulders of granite rock, 60 feet at a leap, into the most enchanting fairy dells, with gnarled trunks clothed in green velvety moss, tree-ferns, orchids, and waterfalls. In this amphitheatre the villages are picturesquely situated on the tops of the ridges, and the flanks are laid out in gardens.

Mr. Reid and his party ascended to the base of the Namuli peaks, but found it impossible to ascend them. Last tried them from all sides, but had to give up the attempt. They rise in sheer masses of granite to a height of 1500 to 2000 feet, separated by a forest-clad gorge. Their height has been computed at 8000 to 9000 feet, or 6000 feet above the surrounding country.

Kambole, Tanganyika Plateau.—Dr. James G. Mackay has kept a record of rainfall and temperature at this station of the London Missionary Society since October 1. The following is a summary of the readings for the last three months of 1897 :—

	Temperature, 8 A.M. Min. Therm.			Temperature, 5 P.M. Max. Therm.			Rainfall in Inches.		
	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.	Total.	Amount in One Day.	Number of Rainy Days.
October, . .	63	52	57·90	90	66	84·10	1·35	1·00	4
November, .	60	54	52·13	86	68	78·11	7·67	1·27	16
December, .	60	53	57·06	85	69	78·19	6·17	2·18	18

GENERAL.

Standard Time.—The Royal Society of Canada having sent to this Society a memorandum on the "Unification of Time at Sea," accompanied by a letter in which the Society was invited to join in petitioning Her Majesty's Government to sanction the proposed changes and to cause the *Nautical Almanac* to be adapted to a day beginning at midnight, the subject was referred by the Education Committee to Professor Copeland and Dr. Burgess. The referees did not regard the scheme with favour. The *Nautical Almanacs*, including the one for 1901, have all been compiled for a day beginning at noon, and seamen work up their day's run at noon ; and the referees were informed that any change in this respect would inevitably be fraught with danger to shipping, for a time at least, while the advantage to be derived from the change is not clearly apparent.

There is, however, another direction in which the referees consider that the Society may use its influence with advantage. Now that there is such rapid communication with all parts of the world, there is great need for a universal "standard time." The time in use in various countries should be referred to a common meridian,

and differ, if possible, from the mean time at that meridian by a whole number of hours. The system has already been adopted in many countries: Great Britain, Belgium, the Netherlands, and Portugal use Greenwich mean time; Norway, Sweden, Denmark, Germany, Austria-Hungary, Switzerland, Italy, and Malta use Mid-European time—1 hour E. of Greenwich; Cape Colony, 1½ hours E.; Natal, 2 hours; Japan, 9 hours. The United States and Canada are divided into four zones, in which Intercolonial Time (4 hours W.), Eastern Time (5 hours W.), Central Time (6 hours W.), Mountain Time (7 hours W.), and Pacific Time (8 hours W.), are respectively employed. The standard in West Australia is 8 hours E.; in South Australia, 9 hours E.; in Victoria, New South Wales, Queensland, and Tasmania, 10 hours E.; and in New Zealand, 11½ hours E. Recently the French Chamber has decreed that the national time shall be that of the meridian of Paris, less 9 min. 21 secs.—that is, Greenwich time.

It is to be regretted that Cape Colony has not conformed to the time of Natal, thus avoiding the half-hour, and in New Zealand it would have been better to have taken 11 hours as the standard; 12 hours might introduce some uncertainty as to the day of the month.

From the Admiralty *List of Time Signals* it appears that time is officially distributed to seamen at 153 stations scattered over the globe. At 94 of these stations the time signalled is either Greenwich mean time or differs from it a certain number of hours or half hours. At the remaining 59 stations another initial meridian is chosen, local mean time being adopted in the majority of cases. Of these 59 stations, 21 are situated in British Possessions, where the divergence from the general usage must prove peculiarly inconvenient. At several of them the local time could be brought into accord with the general system by small corrections that would have no effect on daily life. Thus, the local time of Mauritius differs by less than 10 minutes from that of 4 hours E. of Greenwich, and unimportant corrections would reduce the times of Trinidad, the Windward Islands, and Bermudas to that of 4 hours W.

In India great discomfort was experienced until Madras time was recognised on all the railways, and the continued use of local time in Bombay—half an hour behind railway time—is frequently the source of vexatious mistakes. The difficulty might be removed by the adoption of a standard time 5 hours earlier than Greenwich time for all purposes, and the daily routine of life might be accommodated to a common time extending over 30° of longitude by making the hours of business, school attendance, etc., rather earlier in the eastern parts of the country, and correspondingly later in the western.

It may be mentioned that, wherever standard time has been introduced, the public have quickly learned to appreciate its advantages over the old system.

The report of Professor Copeland and Dr. Burgess met with the full approval of the Committee, and a petition to the Secretaries of State, asking them to use their influence to fix the time intervals of the Colonies, India, and Ireland at an integral number of hours, is now under consideration.

MISCELLANEOUS.

Dr. Erich von Drygalski has been appointed to the leadership of the **German Antarctic Expedition.**

The meeting of **German Naturalists and Medical Men** will be held this year at Düsseldorf, from Sept. 19th to the 24th. The geographical section will be under the management of Herr P. Fuchs and Dr. F. Cramer.

Dr. Otto Nordenskiöld left Gothenburg at the end of March for Alaska, where he will make geological observations. A chemist and engineer will accompany him to study the processes of gold-mining, and make ethnographical collections. —*Globus*, Bd. lxxiii. No. 17.

The **Geographical Society of La Paz**, Bolivia, founded in 1889, has commenced to publish a journal. The first number, consisting of 159 pages, contains among its articles a monograph of the province of Muñecas, an account of the province of the Mojos, written two centuries ago by a Jesuit missionary, with an introduction by Don M. V. Ballivian, and a statement of the boundary dispute with Peru, by the secretary.

The **Indian population of Canada** numbers 99,364, or 611 fewer than last year. Births and deaths are nearly equal. The material condition of the Indians is much improved, and they suffer less from scrofula and consumption, but many have died of influenza. More than 70,000 are, nominally at least, Christians. There are 285 Indian schools with 9628 scholars. Four tribes in British Columbia have deposed their hereditary chiefs, and substituted a democratic form of government.

Pekin has now for some months been connected with the sea by a railway. The railway system of Pe-chili, now open to traffic, has a length of 290 miles—79 from Pekin to Tientsin, 27 from Tientsin to Tung-ku, a little above the Taku forts, 144 from Tung-ku to Shan-hai-kuan, where the Great Wall comes down to the sea, and a prolongation of 40 miles towards the north-east, towards Mukden. There is considerable traffic on all the sections. On the Pekin-Tientsin section the receipts are at the rate of fully £1900 per mile annually.—*Revue Française*, Feb.

The Swedish Government contemplates measuring an arc in the **Arctic regions**, and will invite the Russian Government to take part in the work. In 1861 and 1864 Torell and Nordenskiöld turned their attention in Spitzbergen to the practicability of the undertaking, and a commission was appointed in 1893. Now there appears to be more prospect of the realisation of the scheme, for a preliminary expedition is to be sent out this summer to Spitzbergen to make the necessary preparations.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd xxv. Nos. 2 and 3.

M. L. Caillelet recently presented to the Paris Academy of Sciences an instrument by which the **height of a balloon** may be determined, and the relation of barometric pressure to altitude. A photographic apparatus, with its object-glass directed to the ground, is controlled by clock-work, so as to take a photograph every two minutes, while by another camera the position of the needle of an aneroid barometer is recorded simultaneously. Given the focus of the object-glass, the distance of two points on the ground, and their distance on the photographic plate, the height can be determined by proportion, and the image of the barometer gives the pressure at this height.—*Ciel et Terre*, May 1st.

In the *Bol. de la Soc. Geografica de Lima*, Año vii. Trim. 2, Señor Moreno draws attention to the decrease of population in the **capital of Peru**. After increasing steadily up to 1891, when it was 103,956, the number of inhabitants fell to 100,194 in 1895. An examination of the registers shows that the cause is not a low birth-rate, for in 1895 it was 30·69 per 1000, and 34·81 per thousand in 1896, while the mean for the years 1886 to 1896 was 44·34, or larger than in the chief towns of Europe. Consequently Dr. Moreno looks for an explanation on the mortality. From 1864 to 1874 the death-rate was 53·64 per 1000, from 1875 to 1885 it was 53·95, and 44·92 from 1886 to 1896. The most striking fact is the great mortality due to tuberculosis, which accounted for 27·71 per cent. of the

deaths in 1894, against 22·4 per cent. in 1890, and 1844 in 1857. In Callao the mortality has been on the average 86·64 per 1000 during the years 1890-96, and here also tuberculosis is very deadly.

Mr. W. S. Bruce submitted his collection of birds collected on **Franz Josef Land** to Mr. Eagle Clarke, who has published the results of his examination in *The Ibis* for April, together with notes by Mr. Bruce on the haunts, etc., of each specimen. A full list is given of all the birds that have been observed in the archipelago, twenty-two in number, and of these Mr. Bruce obtained or observed nineteen, five of which had not previously been recorded. Besides these, there are several species which have been reported as occurring in the archipelago, but probably through error. Besides the Jackson-Harmsworth expedition, the only authorities on the avifauna are Payer, Nansen, and papers published by Colonel Feilden and Dr. Neale on the birds observed during Mr. Leigh Smith's voyages in the *Eira*.

The ornis of Franz Josef Land seems, though abundant in individuals, to be poor in species, Novaia Zemlia yielding forty-three, and Spitzbergen twenty-nine. Of its twenty-two species, only ten have been found breeding (though several more undoubtedly nest there), while several of the birds are mere stragglers. Dr. Koettlitz, geologist to the Jackson-Harmsworth expedition, has recorded the dates of arrival and departure of many of the birds.

NEW BOOKS.

Side-Lights on Siberia. By James Young Simpson, M.A., B.Sc. With numerous Illustrations. Edinburgh and London: William Blackwood and Sons, 1898. Pp. 383. *Price* 16*s*.

This volume had the honour, which it deserved, of being virtually reviewed last March by Dr. James A. Greig in his delightful lecture to the Society on his journey from Manchurian Kirin by Vladivostok to Leith, which occupied seventy-six days, and cost only £75. Dr. Greig reversed Mr. Simpson's route, going from east to west, using the new Siberian railway for 200 miles from Vladivostok to Imann, and striking it again at Kansk, to which it was then completed without a break from Petersburg. On the three points of interest, the Siberian railway, the prison system, and the strength of Russia, Dr. Greig confirms what he justly terms the "able" descriptions of Mr. Simpson. Since both of these authorities were in that region the Siberian railway has been carried on from Kansk to Irkutsk, and we may expect it to be pushed forward with new vigour, not so much to fill up the gap towards Vladivostok, as to turn away south by Kirin, till it connects Port Arthur, Talienwan, and, virtually, Peking, with Petersburg and Moscow, while we look on from Wei-hai-wei. The new concession extorted from China will doubtless result in the completion of the direct line before 1903. By that time the length of the mighty and wise enterprise will have grown from the original 4741 miles to at least 5500, and the cost from £34,700,000, as estimated, to £40,000,000 sterling. But then Peking will be only ten days from London, and the 5¾ million inhabitants of Siberia, as revealed by the census of 1897, will again be doubling that number.

Meanwhile Mr. Simpson's book will remain for a time the first authority on Siberia and its administration. He had the great advantage of the counsel and help of Prince N. S. Galitzin, a frequent visitor to Edinburgh, and a worthy

representative of one of the most philanthropic of the old Russian families. His own powers of observation, however, and his impartiality, are so remarkable in so young a writer, that while we accept his conclusions, on the whole favourable to the autocracy of Russia, we regret his silence, comparatively, on its intolerance. Jews, Raskolniks, Stundists, and dissenters of all kinds from the Czar's Greek Church, are evidently a blessing to Siberia, so far as they have sought there some of the freedom denied in the European provinces. Is the railway to have as its first result the reducing of half Asia under the iron Erastianism and persecuting zeal of the Holy Synod, so-called, and as its second, the expulsion of the Scottish physicians and missionaries, like Dr. Greig and Dr. Ross, from Manchuria, as their predecessors were driven from the Caucasus to find an asylum in British India? Mr. Simpson will perfect his good book if, in a second edition, or *Blackwood* article, he will frankly discuss the question of ordinary toleration in the Russian Empire. He writes only this, as if permanent progress were possible so long as the Czar allows the Holy Synod to rule in his name with an intolerance worse than mediæval: —"What lies before Russia is the education of her people—not only the peasant, but also the middle classes. Before this has been achieved freedom is impossible. Teach the people the elements of morality—they have yet much to learn; give them to understand the larger questions that touch humanity and the world at large; show them the possibilities, and let them feel the obligations, of a larger life. And the well-tried bureaucratic system, fit type of arrested development, but till then not antiquated, will be sloughed off, unequal to the expanding life within, and Russia will be free indeed. The day belongs to those who feel the pressure, provided that they refrain from one thing—resisting it with violence."

The Faröe Islands. By J. Russell-Jeaffreson, F.R.G.S. With Map and Illustrations. London: Sampson Low and Co., 1898. Pp. 272. *Price 7s. 6d.*

A book to be recommended to one in quest of a fresh field for a summer holiday. The Faröe or Sheep Islands are easily accessible by steamer. They offer wonderful coast and fiord scenery, the cliffs often rising sheer from the water to the height of 1000 feet and more. One of the rocks—the Witch's Finger—is a single pinnacle 3000 feet high, the last 300 or 400 feet forming a needle-like point, which rises from the shoulder. The climate is bracing, and Mr. Jeaffreson recommends a visit to the island as an excellent tonic equal to a long sea-voyage. He made his headquarters at Thorshavn, the capital, but visited nearly all the islands of any size (about twelve in number) and had good sport in fishing and shooting. The trout-fishing in some of the lakes is exceptionally good. The Sörvaag Water, six miles long, was literally alive with fish, the average weight of which was about 3 lbs. One Englishman killed over 150 large fish in a day. Mr. Jeaffreson had a most hospitable reception from the people, from the governor down to the humblest farmer and fisherman he met. They seem to be a fine race of people, thoroughly Scandinavian in type and character. Some of the fishermen he describes as "big, fierce, bold men, with blue eyes, strong beards; most of them tall and powerfully built." They are very superstitious, and delight in legends, some interesting specimens of which are given. Fishing is the great industry, the islands owning about forty smacks. Cod are taken in great quantities in spring and later in the season off the coasts of Iceland, and sent as stock-fish to the Mediterranean. An exciting description is given by Mr. Jeaffreson of whale-"driving." Herds or schools of bottle-nosed whales, averaging about 600 fish, but varying from half a dozen to 2000, frequent the islands. When they appear, they are pursued by the fishermen in their boats, and chased into one of the ports, where they are stabbed

or stranded. The whales average £3 in value. The flesh is eaten and relished. In 1843, 3143 were caught; in 1893, 1600; so that whale-hunting forms no inconsiderable source of income to the Faröese. Mr. Jeaffreson writes in an easy, unaffected style, and his descriptions are often graphic and picturesque. There are a useful index and a really excellent map, which, however, is rendered almost useless to one who wishes to consult it often by being inserted at the beginning of the book with its back to the reader—a not uncommon, but very serious mistake in books of travel.

The Life of Sir Stamford Raffles. By Demetrius Charles Boulger. London: Horace Marshall and Son, 1897. Pp. xv + 403.

"Stamford Raffles is a name we need not fear to put in the same class with Robert Clive and Warren Hastings, with Wellesley and Dalhousie." Such is the claim made by the writer of this work for the subject of his biography, but we fear that however willing to concede to Stamford Raffles a high place in the list of the makers of Greater Britain, posterity will never place him in the same category with Clive and Hastings. Posterity naturally and, on the whole, wisely judges by results, and when we ask what Raffles contributed to the empire the answer is "Singapore and nothing else." And even as regards Singapore, it has to be remembered that the expedition which actually resulted in the seizure and occupation of Singapore had for its object the seizure and occupation of Rhio, a third-rate harbour on the south of Sumatra. Sir Stamford's career, brilliant although it seemed, was in reality disappointing, and doomed, for no fault of his, to be almost fruitless. He was always in advance of his age, but soon after his arrival in the East—if not indeed even before his arrival—he allowed himself to be dominated by one idea, viz., hostility to the Dutch. This idea was not necessarily a bad one. On the contrary, had he kept it judiciously in the background, and not blazed it abroad in letters and despatches, he would have won and retained the sympathy and support of the Eastern and Home authorities. But, unhappily, his name became synonymous with antipathy to the Dutch, and any project he engaged in or proposed was looked on with suspicion by the authorities, who were tired and exhausted with the protracted wars of Napoleon, and above all things desired peace.

But when we come to consider Sir Stamford Raffles as an administrator and statesman, we can readily concede to him a place in the first rank of our Eastern proconsuls. During his short reign in Java he introduced and perfected reforms for which his name is still remembered and blessed by the people. He abolished slavery; he put an end to the use of torture and to the horrible penalties of mutilation which had been in vogue under the Dutch, and he abolished the system of forced labour under which the island was becoming depopulated. He saved the island from bankruptcy, rearranged its currency, and introduced trial by jury and a new system of land tenures. All this was effected with a single eye to the physical, material, and moral improvement of the inhabitants, although he had only too well-grounded reasons to believe that he would never be allowed to see the results of his labours, and that, indeed, his labours would be rendered fruitless by the restoration of the island to the Dutch. In no way disheartened by the prospect, he acted throughout on the simple, generous, and statesmanlike maxim of his friend Lord Minto: "While we are in Java, let us do all the good we can." The good he did was not confined to the Javanese, for he opened the island up to the scholars and men of science of the West, to whom, ere his time, it had been practically a *terra incognita*. His investigations as explorer, archæologist, ethnologist, grammarian, and natural historian were very remarkable when we remember

the circumstances under which he conducted them, and it is to be regretted that the writer of this book has said so little about them.

In perusing this biography we cannot help being struck with its unfortunate apologetic tone, for which there is now not the slightest necessity, and which certainly leaves the uncomfortable feeling that *qui s'excuse, s'accuse*. Far too much weight has been assigned to a couple of ambiguous and erroneous lines in the now utterly forgotten Colburn's *Biographical Dictionary*. And after the published minutes and despatches of the Board of Directors of the East India Company, dealing with the accusations of Gillespie and Farquhar, it is merely wearisome slaying the slain to go into the details of these accusations, and show that they were not founded on truth. The unimpeachable integrity and uprightness of Sir Stamford Raffles are now acknowledged as absolutely as his restless energy and far-seeing statesmanship. Where he failed was in convincing his employers that his plans and projects were judicious and feasible. They longed for peace, he longed for war; they were determined to put a limit to the growth of the empire in the East, he was equally bent on extending the empire, by including within it the whole of the Eastern archipelago, and he even attempted to establish friendly relations with Japan. Time has declared in favour of the far-seeing but ill-fated administrator, and never more emphatically than at the present day, when a new Eastern question of portentous dimensions has appeared to engross the attention of the Western nations. If Java and the Eastern archipelago had been for half a century under British rule, as Sir Stamford would have had it, how different would be the condition of these islands now, and what a preponderating influence and position this country would hold in the East, as compared with what it has!

The East India Company never rightly appreciated one of its ablest and most devoted servants, and there is no darker stain on its usually glorious annals than the story of its ultimate treatment of Sir Stamford and his widow.

Builders of Greater Britain. Sir Walter Ralegh. By MARTIN A. S. HUME. London: T. Fisher Unwin, 1897. Pp. xviii + 431. *Price 5s.*

Among the many illustrious and versatile men of mark in the Elizabethan era there were few more illustrious, and none more versatile, than Sir Walter Ralegh; and the editors of the "Builders of Greater Britain" series are well advised in commencing their series with the story of his life. Previous biographers have brought into sufficient prominence his claims to the admiration of posterity as a historian, a philosopher, a courtier, a sailor, and an adventurer; and the world does not forget that to him we owe the introduction of potatoes and tobacco into England, and we are still grateful for both. But in this volume the aspect of Ralegh's character and career, which is most prominently portrayed, is that of the far-seeing statesman, who foresaw the rise of the British Empire on the ruins of that of Spain, and who deliberately set himself to lay its foundations on the other side of the Atlantic. In an age when kings and statesmen, Catholic and Protestant, buccaneers and soldiers, were ready to encourage and undertake any enterprise from sheer lust of gold and plunder, when "there was no peace beyond the line," Ralegh was the one man who rose superior to such sordid considerations, and, far in advance of his age, strove to impress on the authorities of England that the true interest of this country was to plant colonies and extend its territory and dominion across the Atlantic, rather than to capture Spanish galleons or to raid Indian towns and mines. The story of Ralegh's endeavours in this direction has been most graphically told by Mr. Hume, and a sorrowful story it is. Everything was against him. The parsimony and capriciousness

of the vindictive self-conceited queen, the unreasoning distrust and malignant envy of his fellow-courtiers, his own rash impetuosity of temper, his carelessness of details and generous overtrustfulness of comrades who thwarted and betrayed him, his foolish disdain of public opinion, his impatience of obstruction, his somewhat nebulous and visionary plans and objects—all worked to the same end, viz., mournful failure and a disgraceful though undeserved death, than which there is no blacker stain on the inglorious records of the reign of the modern Solomon King James I. Truth, we know, is stranger than fiction, and as we now have the truth regarding the rise and fall of Sir Walter Ralegh, it is not too much to say that the truth as elicited from contemporary records is stranger than any fiction, and is rather what we might expect to find in a fantastic romance. Queen Elizabeth, however much she appreciated Cecil and Walsingham, seems never to have understood that in Ralegh she had a captain and administrator who could and would have effectually paralysed the power of Spain in the Western continent, whence for the most part Spain was drawing her sinews of war. Instead of permitting him, or rather encouraging him, to lead his expeditions to Virginia as he so ardently desired to do, she with characteristic meanness allowed him to ruin himself and his friends by incurring the whole of the cost, and kept him dangling ingloriously at her side, pretending ecstasies of personal admiration and affection, couched in language which, even when we make allowance for the exaggerated fashion of the day, is obviously hollow and ridiculous. And apparently she never forgave him for his romantic marriage with her maid-of-honour, the fascinating Elizabeth Throgmorton, who proved herself so loving a wife and true and tender a helpmate alike in prosperity and in adversity. King James I. was a pusillanimous coward, the tool of upstart favourites like Carr and Buckingham, and a puppet in the hands of Gondomar, the astute Spanish ambassador, who had only to threaten war to frighten the king into conceding anything his imperial master desired; and what could be more gratifying to the personal spite and national vanity of the King of Spain, than the fall and shameful death of the man who had done more to ruin the Spanish Empire than even Drake and Howard!

Mr. Hume has told his story well. He has utilised to the full all the contemporary documents lately discovered, which throw light on those eventful days. He is well aware of, and does not conceal, the weaknesses and mistakes of his hero, and as we said before, although he does full justice to Ralegh as a philosopher, historian, and courtier, he keeps his imperial colonising aspirations prominently in the foreground. The interest of the story never flags, and we commend it heartily to the perusal of our readers.

Un Sejour dans l'Ile de Java. Par Jules Leclercq. Paris: E. Plon, Nourrit et Cie., 1898. Pp. 294. *Price 4 frcs.*

In this book we have an account of an expedition to the Dutch colony of Java in the year 1895. The author's principal object seems to have been to ascend as many of the volcanoes as was practicable, and he also has a good deal to tell us of the principal towns and of the remains of Hindu and Buddhist architecture, which are to be found here and there in various parts of the island. Much the most interesting of his chapters is the last, in which he gives us a succinct and fairly clear account of the administrative system through which the Dutch rule the island, and to this he adds a historical *résumé* of the policy of the administration since the colony passed into their hands. Originally the recognised and avowed policy of the Dutch government was to constitute itself master of the whole of the soil of the island, and to work the land by means of forced labour. The system, however,

broke down, and now forced labour has been practically abolished and the lands are granted freely on long leases to colonists, with excellent results both to the colony and to the Imperial exchequer.

The author was indefatigable in his self-appointed task of climbing the volcanoes, and his descriptions of the country he passed through, and the scenery and landscapes he saw, though somewhat monotonous, are eloquent and graceful. He had no startling adventures with which to enliven his book. He never came across a tiger, which the natives there call "Monsieur," though he passed through many jungles infested by these animals. Nor did he ever meet a rhinoceros. On the other hand, he gives us an effective description of the progress already made in Java—especially in the development of the country by the construction of roads and railways. If we are to believe what he says of the latter, the feats of engineering and the difficulties overcome in the construction of the famous line through the Rocky Mountains were nothing as compared with those of the line through Java. The increase in population in the island during this century has been phenomenal, viz., from three and a half millions to over twenty-five millions of souls. The latter figure gives a density of population of over 490 to the square mile.

There are some good illustrations and a useful map.

The Routes and Mineral Resources of North-Western Canada. By E. Jerome Dyer, F.R.G.S. London: George Philip and Son, 1898. Pp. 268+xx. *Price* 6*s*.

Appearing as it does at the time when every one interested in mining enterprise has his eyes directed towards the north-western corner of the Dominion, this volume is sure to receive a hearty welcome. It is a first attempt at a comprehensive handbook on the mineral resources of a remote part of the empire, which, though as yet imperfectly explored, appears to be full of promise as a field for mining and commercial enterprise. It does not profess to be more than a compilation of materials from a variety of sources. The compiler has laid over a hundred authorities under contribution, and has drawn largely from official publications and geographical works, so that the general accuracy of the statements may be relied on.

The mineral resources of North-West Canada include, besides gold, valuable deposits of iron, copper, coal, and petroleum. Curiously enough, at some parts of the Yukon district large deposits of ivory have been found—the remains of extinct animals of gigantic size, apparently akin to the mammoths that once roamed over the steppes of Siberia. Indeed, the north-west of Canada is said to resemble parts of Siberia and Northern Russia in many respects. It is, of course, the gold of Klondyke that dazzles the eye of the average seeker after wealth, but the discovery of coal and petroleum in a country where, for half the year, the chief necessaries for a comfortable existence are heat and light, is a matter of scarcely less importance.

The all-important question of the routes to Klondyke is discussed at length, and an excellent map is given on which these are distinctly shown. Geographically, the routes may be classified under four heads, corresponding respectively to the cardinal points of the compass:—

1. Routes from the east, entirely through Canadian territory.
2. The southern routes, including those *via* the Pacific coast, by which most of last year's traffic was conducted.
3. The only route from the west is *via* the Behring Sea and up the Yukon river in Alaska.
4. The northern route, including a long sea-voyage through Behring Strait and the Arctic Ocean to the mouth of the Mackenzie River.

Of these routes one of the most important, so far at least as British travellers are

concerned, runs through Hudson's Bay, Chesterfield Inlet, Lake Aberdeen, the Great Slave Lake, and down the Mackenzie River. For a summer journey this route has enormous advantages, as it can be followed by water—rivers, lakes, or open seas—nearly the whole distance, and is not crossed by any difficult mountain ranges. It is, moreover, entirely in British territory, and for all travellers from "our side of the pond" is, according to the compiler, likely to be the route of the future. The region it traverses is not of interest to the miner alone, as it is a splendid sporting and fishing country, and, being still imperfectly opened up, is full of fascination for the lover of untrodden paths.

A list of the necessary outfit, with particulars of the price of provisions, etc., at Klondyke last year is given at the end of the book, as well as miscellaneous notes on the geological character of the gold deposits, etc. The information is rather scrappy, and might with advantage have been compressed and condensed at places, and it is to be hoped that the compiler, when a second edition is required, will bear in mind that a hand-book for travellers should, like extract of meat, be as concentrated as possible, so that it can be easily carried in the pocket and consulted by the way, instead of having to be left behind on account of the quantity of spare paper it contains. The volume is full of useful information, and intending visitors to Klondyke will do well to study it before they set out on the journey.

The Kingdom of the Yellow Robe, being Sketches of the Domestic and Religious Rites and Ceremonies of the Siamese. By Ernest Young, late of the Educational Department, Siam. With Illustrations by E. A. Norbury, R.C.A. Westminster: Archibald Constable and Co., 1898. Pp. 399. *Price* 15*s.*

It is not every Briton abroad who takes pains to inform himself on native life and manners in the land of his exile as Mr. Young has done, nor is it every one who could give the world the information he has collected in so lucid and attractive a form as this. While there is little or nothing in the book new to those who know Siam, there is much that is interesting and suggestive. The ordinary and extraordinary events of Siamese daily life, the customs, habits, and leading ideas of the people, are described with picturesque fidelity. The author avoids political questions, and refrains from political predictions,—a kind of self-denial almost impossible to the European who writes about Siam. He contents himself with portraying the people as they are, adding here and there moral reflections, some of which might make logicians and philosophers blaspheme. His pictures are painstaking and accurate, and he has consulted the best authorities for the ideas that have made and control the ritual of Siamese religious and social life. The full-page illustrations are good, being chiefly reproductions of photographs, but some of the smaller drawings are hardly worthy of a place in a work otherwise well got up. As Europe is likely to hear a great deal of the Siamese in the near future, it is good that books giving trustworthy accounts of their life and manners should be in the hands of the public, and Mr. Young's book can be recommended as a well-executed social map of a country as yet little known in the West.

The English Angler in Florida. With some Descriptive Notes of the Game, Animals, and Birds. By Rowland Ward, F.Z.S. With numerous Illustrations. London: Rowland Ward, Limited, 1898. Pp. xii + 122. *Price* 7*s.* 6*d.*

Mr. Rowland Ward, who is well known as an artistic taxidermist and as an enthusiastic sportsman with rod and gun, has yielded to the wishes of his friends in publishing this record of his angling experiences in Florida. The story, such as

it is, consisting of the author's breezy narrative and his wife's unedited diary, centres round the name of Tarpon. This "silver king" or "big-eyed herring" may measure five to seven feet in length, and seems to afford exciting sport. Mr. Ward landed one of 128 lbs., and Mrs. Stagg holds the record with one of 205lbs. As to the angling for this big fish, the author has sagacious advice to offer; of the fish itself he tells us nothing new. And as the fish practically fills the whole book, it is a pity that there is no good figure of it. There is, however, a beautiful figure of one of its scales. The book is interesting reading; to an angler it may even be exciting; in the scientific mind it leaves the regret that the author had not a little more to say.

Egypt in the Nineteenth Century, or Mehemet Ali and his Successors until the British Occupation in 1882. By D. A. Cameron. London: Smith, Elder, and Co., 1898. Pp. 276; map and index. *Price* 6*s.*

The publication of this book is opportune. All eyes are turned to Egypt, and will be so turned for some time to come. Few understand the Egyptian question, but after reading this book, no one, we believe, will fail to understand the great importance of the future of the Nile Valley, or the numerous factors which have led Great Britain to occupy the country.

The account of Mehemet Ali, his rise, his greatness, and his fall, is extremely good, although we could perhaps wish that the author had not written quite so briefly, as a somewhat more lengthy narrative would have been easier for most people to grasp. The condensation of such a story, although well balanced, requires careful reading and thoughtful study.

The terrible sufferings of the natives during the past century are clearly shown; the great fertility of the country is demonstrated; the causes of the difficulties into which Egypt was led by her rulers are made perfectly plain, and politicians will doubtless value the book as it appears to them as well as to the general reader.

The future of Egypt depends upon this country now, and, according to the grasp our rulers have of the situation in the near future, it will depend whether the inhabitants are to have peace and prosperity or chaos.

Errors enough have been made in the past; if attentively read, this book should help to avoid them in the future.

Mehemet Ali told Burckhardt in 1815, "England must some day take Egypt as her share of the spoil of the Turkish empire." His forecast, if not quite justified at present, bids fair to become correct.

Neunzig Tage im Zelt: Meine Reise nach Uhehe, Juni bis September 1897. Von Liebert, Generalmajor, Kaiserlicher Gouverneur von Deutsch-Ostafrika. Pp. 48, and Sketch Map. Berlin: Mittler und Sohn, 1898.

This is a brief account of a three months' journey taken by the Governor of German East Africa, from Dar-es-Salam *viâ* Kisakki to Kidatu, to see for himself if the Uhehe district was fitted for the residence of German farmers. We may sum up his conclusions as follows:—

1. The Ulanga Plain. Hot, tropical, profitable for the growth of rice, tobacco, and india-rubber. Average altitude, 900 feet above sea-level. Not suitable for colonisation owing to the flooding of the rivers and other climatological factors.

2. The Uhehe mountain district, about 10,500 qkm., of which about 5000 are mountain and 5500 meadow-land, some 4800 to 6900 feet above sea-level, may be considered as a tropical health resort. The fertility of this district ensures its agricultural success in the future.

3. In the meadow-land, 4200 to 4800 feet above sea-level, there is a good prospect for success in agriculture and cattle-breeding, and Europeans can exist there.

4. A mixed zone, meadow and arable land, having the character of 2 and 3.

5. The grass land in the upper reaches of the Ruaha river. Fruitful, but unhealthy, and not suitable for a residence for Europeans.

On his return journey, the Governor notes with sorrow that a large part of the colony is not valuable owing to want of water and depopulation. The natives he encountered were most friendly and willing to trade.

The Story of Hawaii. By JEAN A. OWEN (Mrs. VISGER). London and New York: Harper Brothers. Pp. vii + 219. *Price* 5*s*.

The story of Hawaii is always interesting, and Mrs. Visger has told it in this book in a bright and pleasant manner. Her appreciative descriptions of the natives, their myths and customs, and her sympathy with the many vicissitudes of their history, show that she has felt the spell of these islands. In spite of a discursive style and the occasional use of such a barbarous word as "chiefess," the book may be cordially recommended to those who wish to gain a general acquaintance with the past and present circumstances of the "Paradise of the Pacific." It is startling to learn that there was living last year a native woman who was alive at the time of Captain Cook's murder. She had attained the age of 122.

The Missionary Expansion of the Reformed Churches. By the Rev. J. A. GRAHAM, M.A., Missionary of the Church of Scotland Young Men's Guild at Kalimpong, India. Edinburgh: R. and R. Clark, 1898. Pp. xv + 246.

The literature of missions is so large that few readers can spare sufficient time to make themselves acquainted with the progress that has been made in even a part of the missionary field. Many friends of missions will therefore be glad to possess this short summary. It must have required a large amount of labour to collect the material, and much thoughtful care to select the most essential details and represent them in so condensed a form. Hardly a sentence in the book is superfluous. The style in a book necessarily so full of bare facts cannot be quite as light as that of the author's former work, *On the Threshold of Three Closed Lands*, but a wonderful degree of continuity is maintained in the narrative, and a judicious blending of biographical notes, remarks on the native races and their customs, and anecdotes showing the difficulties missionaries have had to contend with, carries the reader along without weariness. The illustrations are numerous and useful.

The book deserves a longer notice, and we should be glad to discuss it more fully were its subject more closely connected with geography.

Gazetteer of the Shahpur District. By J. WILSON, I.C.S., Deputy Commissioner and Settlement Collector. Revised Edition, 1897. Lahore: *Civil and Military Gazette* Press, 1897. Pp. xii + 240 + lv.

The first Gazetteer of the Shahpur district in the Punjab was published by the Government of the Punjab in 1884. We have now before us the second edition, which has been edited by Mr. J. Wilson of the Civil Service, and is about double the size of the first. It is a compendium of information regarding Shahpur, a somewhat obscure district in the Rawal-pindi Division, and is a good

example of the thoroughness of the work which issues from the Government Press. So far as Shahpur is concerned, the Gazetteer is a sort of "inquire within about everything." It contains an excellent description of the physical features of the district, with notes of its fauna and flora; a *résumé* of its history and remarks about its archæological remains; a good account of the people, with much information regarding their social and religious customs, their distribution into tribes and castes, with notes of the history of their leading families; an interesting account of the system of agriculture, which is, of course, the principal industry of the district, and of the system of administration—civil, criminal, and revenue. In this district, which has an area of 4741 square miles, the population is under half a million; and of a cultivable area of over 4200 square miles only 1200 have been cultivated. The Gazetteer bristles with tables of statistics, from which we learn that steady if somewhat slow progress is being made in population, education, sanitation, and the like. Dispensaries are becoming popular. In the last ten years the numbers of indoor and outdoor patients have risen from 962 and 76,296 to 1289 and 116,762. There is only one town in the district with a population of over 10,000. The report is equipped with a map and a good index.

Constable's Hand-Gazetteer of India. Compiled under the direction of J. G. Bartholomew, F.R.S.E. Edited with additions by Jas. Burgess, C.I.E., LL.D., F.R.S.E. Westminster: Archibald Constable and Co., 1898. Pp. 400. *Price* 10*s.* 6*d.*

This work, as we gather from the prefatory note, contains some twenty thousand place-names, taken from the index to Constable's Hand-Atlas of India, the Imperial and Provincial Gazetteers, and Postal Directories. Even with this it does not pretend to be exhaustive, but claims to be merely a book of general reference on the topography of India, and useful as a companion to an Indian atlas or map. As such it is certainly to be commended.

Oost-Java en Madoera. Handbook voor Reizigers door Kapitein Fedor Schulze, Ridder, M.W.O. Batavia: A. Kollf and Co., 1897. Pp. 153. *Atjeh in* 1896. Gids voor Noord-Sumatra voor L. F. M. Schulze. Batavia: H. Prange and Co., 1896. Pp. 70.

It is some years since a guide to West Java was published, but these volumes are, we believe, the first of their kind dealing with East Java and Atjeh. They are more than mere guides, especially the latter, for they give a large amount of information on the products of the various districts, history, etc. The directions respecting routes, means of transport, distances, etc., are full, and seem to be carefully compiled. The author is also aware of the importance of maps, and has furnished his guides with a goodly number. They are certainly rough in execution, probably because cartography is somewhat behindhand in Java, but they show the railways, roads, relative positions of towns, mountains, etc.—details so necessary to the traveller.

Neuester Vogesen-Führer. Von Ernst Bader. Freiburg i.B.: Lorenz und Waetzel, 1896. Pp. 176.

This *Guide* appears to contain all the information the ordinary tourist to the beautiful valleys of the Vosges is likely to require. The Alsatian Jura is also included, and there is a useful map of the country between Metz and Basel on a scale of about six and a third miles to an inch. The volume would have been still more handy if the numerous advertisements had been omitted.

NEW MAPS.

EUROPE.

FRANCE PHYSIQUE. Atlas Universel de Géographie, ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Sheet No. 8.
Librairie Hachette et Cie., Paris.

This sheet of the Atlas is beautifully executed and printed in several shades so as to show the elevation. The map would perhaps have been more agreeable to the eye if the green had been a little brighter, especially as a large number of details in black tend to render it more subdued. We should also have preferred another contour between sea-level and 500 mètres, even at the cost of one of the higher contours. Still, as it stands, the map is a very creditable specimen of cartography.

CONSTANTINOPEL, Karte der Umgegend von ——, unter Benutzung der älteren Aufnahmen (1888-1895) erweitert, bearbeitet und gezeichnet von C. Freiherr von der Goltz-Pascha. Massstab 1 : 100,000. *Price M.* 4.
Schall und Grund, Berlin.

A great deal of labour and care must have been spent over this sheet. It includes Constantinople, the Bosporus, and the country about fifteen miles on either side. The grey of the contours, the blue of the rivers, and the brickish red of the towns and walls do not form a pleasing combination. The relief of the surface would have been brought out better by shades of colour than contours alone. Otherwise the map is good and the text contains some useful information.

ASIA.

CHINESE QUESTION, Map to illustrate the ——. *Price* 2*s.*
W. and A. K. Johnston, Edinburgh.

Map of Western China, Japan, etc., with several useful insets—Wei-hai-wei, Kiao-chow, Kwantung Peninsula, etc.

AMERICA.

KLONDIKE GOLDFIELDS, Map of the ——. *Price* 2*s.*
W. and A. K. Johnston, Edinburgh.

Shows clearly the routes by which the mining district may be reached.

WORLD.

SPANISH-AMERICAN WAR MAP. *Price* 1*s.* 6*d.*
John Bartholomew and Co., Edinburgh.

UNITED STATES AND SPAIN, War Map of ——. *Price* 2*s.*
W. and A. K. Johnston, Edinburgh.

Maps showing Cuba, parts of the coasts of America and Europe, etc., with general maps of the North Atlantic.

CORRECTION.

ENGLAND AND WALES, Geological Map of ——. We regret that on p. 280 the price of Ramsay's map was inadvertently quoted as 42*s.* 6*d.*; it is only 32*s.* 6*d.* Ramsay's map was the best that could be compiled with the material then available, and, therefore, was naturally referred to by the reviewer as a standard by which to measure the subsequent growth of geological knowledge as regards England and Wales.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE YUKON DISTRICT.

By Wm. Ogilvie, Astronomer and Dominion Land Surveyor.

(*With a Map.*)

In north longitude 59° 46′ approximately, west longitude 135° 13′, the first trickling streams which unite to form the head of the Lewes branch of the Yukon begin. They converge into a small lake in a deep mountain valley, snow-clad for nearly ten months in the year, less than fifteen miles from which, as the crow flies, in a southerly direction, is the head of Dyea inlet —the most easterly arm of Lynn canal. Out of this lake, known as Summit lake, these waters flow down a turbulent mountain stream, less than half a mile in length, into another smaller lake known as Crater lake, from its resemblance to a crater. This lake pours its waters through a still more turbulent stream into another lake much more extensive, called Long lake, and this again through a short link into Lower lake, which discharges its waters through the cañon into Lake Lindeman. The fall between the two latter lakes is nearly 1000 feet, in an interval of less than three miles. Lake Lindeman is about five miles in length, and its waters discharge by a stream less than a mile in length, which, however, is impassable for ordinary boats owing to bad rapids in the middle, into Lake Bennett. At the head of Lake Bennett we are on the navigable waters of this stream. It is upwards of twenty-five miles in length. At its foot is a small lake known as Cariboo crossing, because it was a favourite place for those animals to cross in their migrations from the south to the north, and on their return. This is connected with Tagish lake by a short, crooked stream, less than 200 yards in length. Tagish lake is about seventeen miles in length, on the route followed by the miners to the Lewes; but extends southwards from the travelled way nearly thirty miles, aggregating in all its arms a consider-

able body of water. Out of Tagish lake we go through a short stream named Tagish river, after the Indians of that locality who used to make it their winter quarters; several of their wooden houses are now standing on its banks. This point has been selected by the Dominion Government for a police station and customs office; and here all miners and others entering the country by this route are stopped, their goods examined, and customs dues exacted on all foreign goods. The stream is about five miles in length, and nowhere less than 100 yards in width. The shallowest part in it is about six feet deep at ordinary stages of water—this only for a short distance near its head. All the rest is twelve feet and upwards. About four miles below the police post we reach Marsh lake, nineteen miles in length, affording good deep water everywhere. Marsh lake averages about one to one and a-half miles in width, and during a high wind becomes pretty rough, as do Tagish and Bennett lakes. On the river twenty-five and a-half miles below Marsh lake we reach the Cañon, and two and a-half miles below this, White Horse rapids. In this series of rapids there is a fall of upwards of thirty feet, about ten of which are in the Cañon within less than five-eighths of a mile, six or seven in the rapids intervening between the Cañon and the White Horse in about a fourth of a mile, and the remainder, of fifteen or sixteen feet, in White Horse rapids in less than half a mile. These rapids are impassable for steamers, and past them a tramway or some other mode of conveyance will have to be constructed for all materials entering the country by this route. This will prove a serious hindrance to transit by this route for all time. Steamers capable of navigating the lakes mentioned in all weathers may prove a little too deep in draught for the river between the foot of Marsh lake and the Cañon; but admitting that they do not, arrived at the head of the Cañon they will have to discharge their cargo, which will have to be conveyed over a tramway or other means of conveyance to the foot of the White Horse, and reloaded on to another river steamer, which will make its way down stream from there as far as may be necessary, without any difficulty.

Twenty-seven miles below White Horse rapids we reach Lake Labarge, a lake upwards of thirty-one miles in length. The upper part of it averages between three and four miles in width, and the lower half nearly two miles. Here, again, river steamers of light draught may be detained by high winds, as a strong wind in a very few hours lashes the water into a very rough state, and of course river steamers of shallow draught have not the necessary depth and stiffness to navigate such waters. Thirty-one miles, or a little more, below Lake Labarge, we reach the mouth of the Teslin, a branch of the Yukon, which is commonly known to the miners, and in fact to all in that country, as the Hootalinqua.

From this point we will now go back and describe the Teslin route. It begins properly at Fort Wrangel, near the mouth of the Stikine river. This post is in American territory, and hindrances may, and no doubt will, be put in the way of the transfer of Canadian or British cargoes from British ocean ships to British river steamers at Wrangel. Should these hindrances be made too troublesome, British ships can discharge their cargo at Fort Simpson in British waters, about 170 miles farther south.

LOOKING UP THE CHILKAT AND CHILKOOT INLETS AND THE DYEA SANKA FROM NEAR POINT SEDUCTION.

LOOKING UP THE DYEA PASS.

LOOKING UP WHITE PASS FROM BELOW FORKS.

(Summit of Pass on left of high ridge in centre.)

LOOKING DOWN CAÑON.

(95 miles from head of Lake Bennett.)

River steamers can, in fine weather, easily make their way from Simpson to and past Wrangel into the Stikine river, traversing on it the narrow strip of territory belonging to the United States along the coast, and as Britain, in the treaty with Russia in 1825 defining the boundary between British and Russian territory, secured the right of free navigation of all streams, inlets, and bays leading from the interior to the waters of the ocean, and again in the treaty between the United States and Great Britain in 1870 this was accentuated by specialising the Stikine river, the free navigation of which was secured to Great Britain and her dependencies in the treaty—it is presumed that the United States cannot possibly raise any objection or put any hindrance in the way of a steamer clearing at Fort Simpson and passing on to Telegraph creek in British territory on the Stikine river.

From Fort Wrangel to Telegraph creek is 150 miles. River steamers have navigated that stream since the early seventies, when considerable mining was done in the northern part of the province of British Columbia in the district known as the Cassiar district. Since that time a small steamer, the *Alaska*, has been almost continuously plying on the river, carrying goods for the few traders doing business in that country. In 1896 and 1897 the Hudson Bay Company's steamer *Caledonian* made four trips, two in each of those years, from Fort Simpson up the Stikine river to Telegraph creek. This steamer draws, when loaded, four feet of water, and on none of these occasions did she meet with any serious inconvenience, except perhaps once when a very heavy rain raised the water in the river so high that immense quantities of driftwood came down, and she had to tie up in a sheltered place until the bulk of it had passed. The only trouble the steamer experienced in the passage was across Dixon's Entrance, which begins immediately at Simpson, and continues for upwards of forty miles to Mary Island. Through Dixon's Entrance from the Pacific Ocean the swell in a storm blows landward, and of course precludes the possibility of an ordinary river steamer crossing during its continuance. This would necessitate a delay, as the steamers would have to abide the event of the weather, and await a favourable opportunity to cross, which could be done in about four hours. When the wind blows from the land there is not so much trouble. As this steamer has made four trips successfully, it may reasonably be argued that other steamers can do the same. Had it been necessary to make more than two trips each season, she could have done so with reasonable security, but that was all that was required of her, and she successfully accomplished it. Her time from Simpson to Fort Wrangel was about seventeen hours, and from Wrangel to Telegraph creek the voyage occupied the bulk of three days, but her actual running time was somewhere about forty hours. The balance was taken up in cutting and loading wood, and tying up at night, unloading freight and passengers, and taking others on again. It was the intention of the Canadian Government to construct a railway from Telegraph creek to Teslin lake, out of which the river already mentioned as the Teslin or Hootalinqua flows into the Lewes. This railway would be about 150 miles in length, and examinations of that piece of

country have shown that there is nothing very serious in the way to prevent construction. The contract was let, and ratified by the House of Commons in Canada, but rejected by the Senate, and it remains to be seen what further action will be taken in the matter. But there is no doubt that a road will soon be constructed between those two points. There is also very little doubt that this road will be continued southwards through the heart of British Columbia, traversing on its way a region part of which is known to be fairly rich in minerals, and will ultimately connect with the Canadian Pacific; and it can be reasonably predicted that it will be a fairly remunerative line, seeing that it will pass through mineral, grazing, and timber country.

Another path, from the head of the Chilkat arm of Lynn canal, is known as the Dalton route. This for upwards of 240 miles is all land travel. Examination has shown that it passes over gently undulating country, where a road would not be difficult of construction. It would also obviate the necessity of transferring the cargo at the rapids mentioned, and avoid delay from rough water on the lakes, by striking the river below the Five Finger rapids, from which point easy navigation obtains down to the boundary line, and beyond it into the Yukon Flats.

The Yukon Flats are about 100 miles in length. In this length the river expands to five, six, and maybe ten miles in width. It is evident that there was at one time a great lake in this stretch of the river, but it has been filled up by silt and drift to such an extent that it is now dotted with numberless islands, and divided into various intricate and narrow channels. These channels are almost continuously changing their depth and direction, so that navigation is at several points very difficult and uncertain. A steamboat may pass up or down easily on one trip, and on her succeeding one come to grief on some bar or the point of some island. This has occurred very often, and in fact was the cause of the threatened starvation at Dawson last winter. In seasons in which the water remains high, little difficulty is experienced here, but in low water this section is simply impassable. After August 1897, no boat navigating the stream could pass one of the points in these flats. The result was that provisions intended for Dawson were detained here for weeks; only two steamers passed it—one with a cargo of about seventy-two tons, and the other with forty-six tons. Their full complement would be about 250 and 300 tons. These flats once passed, there is no further difficulty for about 900 miles, when the river again spreads out into many channels, but the islands are larger and the channels wider. In low water a little difficulty is experienced here at times through missing the right channel, and some search to find a way for the steamer may be necessary. Arrived at the mouth, we again encounter shoal water and crooked channels, which are difficult of navigation, and require the experience of old local pilots, generally Indians. Here, too, the steamers are often detained for days by storms on Bering Sea. From the mouth of the channel steamboats navigate to Fort St. Michael, the emporium for all that district, where the ocean steamers discharge cargo, a distance of about seventy miles, and of course in rough weather river steamboats cannot cross it. The result is that steamers making their way to St. Michael, and also from it,

are often delayed for many days. All these conditions combine to make it tolerably certain that not more than one trip per month can be made by any of the steamers now running—and some of them are fairly good ones—from St. Michael to Dawson. Bering Sea, as a rule, is not open for navigation until towards the first of July. The last ten days in June may be defined as the earliest period in which ships can approach St. Michael—in some cases it has been retarded till well into July. In 1896, the seventh of July was the date of the first arrival at St. Michael of a steamer. As the Yukon river begins running ice in the middle of October, and steamers run some risk after the end of September, we can thus only count on three to three and a-half months for navigation by this route—that is the ocean and river route.

With a railway between Telegraph creek, or any other point on the Stikine river, to the head of Teslin lake, we are assured of about five months' navigation in the year, with the important advantage that loaded steamers make their way down the stream four or five or six hundred miles, as it may be, instead of up stream fifteen, sixteen, or seventeen hundred—a very important difference. By this way the same steamers could make three trips for one as compared with the St. Michael route; and as the Yukon would remain navigable for about the same length of time as the Stikine, this undoubtedly is the route to be opened for the due and proper development of the Yukon district. The Teslin route also obviates the detention and transfer of cargo at the Cañon and White Horse rapids, as a steamer loading at the head of Teslin lake meets no hindrance or stoppage until she arrives at her destination. Possibly a storm on Teslin lake, which is sixty-five miles in length, might detain her, as steamers on the lakes on the other route would be detained; but Teslin lake is not so wide as Labarge, and shelter is afforded along its length at various points, so that it is highly probable the same hindrance to passage will not be offered here as on Labarge.

The other routes to the country need hardly be discussed at present. Just now the Dyea route and the White Pass route—they are so close together as to be practically the same—take the attention of the great bulk of the miners attempting entrance. With a good road over the Teslin route, it may be said that it will absorb seventy-five per cent. of the traffic, if indeed not all. No other route at present spoken of, except the ocean and river route, can at all compare with these, either in time, cost, or comfort.

Gold was known to exist in the Yukon country as early as 1847, for Robert Campbell, who built the Hudson Bay Company trading-post at the confluence of the Pelly and Lewes, found it in small quantities in the gravel of the beach at that point. Gold-mining, however, was not his business, and he paid little or no attention to it.

Some time early in the sixth decade of the present century, a Canadian missionary—now the venerable Archdeacon Macdonald of Fort Macpherson, in the delta of the Mackenzie river—found it at the head of Birch creek, a tributary of the Yukon, which joins it near the Arctic circle in west longitude 146° approximately. This discovery led to the

establishment of the Birch creek diggings and the trading-port known as Circle City, in north latitude 65° 40′ approximately, and west longitude 144°.

Mr. Arthur Harper and his associates made their way from the head of Peace river, in the heart of British Columbia, in September 1872, to the vicinity of Fort St. John, on the upper Peace. Thence they crossed the watershed between the Peace and Liard rivers to a branch of the latter known as the Nelson, down which they went to the Liard, down it to the Mackenzie, and down it to the Hudson Bay Company's portage or route between the waters of the Mackenzie and the Porcupine, a branch of the Yukon. They traversed this portage, ran down the Porcupine, and up the Yukon to White river, up which they went many miles prospecting. Harper summed up his experience in prospecting thus: "On the Nelson, nothing; on the Liard, prospects; on the Mackenzie, nothing; at the mouth of the Peel, which has a common delta with the Mackenzie, good prospects; on the Porcupine, a little; and on the Yukon, gold everywhere we tried." His correspondence with friends whom he left behind led, to a considerable extent, to the resort of miners to that region; and mining on the Yukon may be stated to have begun shortly after that year.

In the early eighties mining was done in earnest along the banks of the Lewes and on the Stewart. The discovery of coarse gold on Fortymile river in 1886 led to the abandonment of all other work in that country, as coarse gold has always been the great desideratum of miners. Fortymile continued to be worked by the vast majority of those entering the country, much against the will, however, of a good many of them, who would have far rather worked on Stewart river had they been able to obtain supplies there, but Fortymile received them all, until the diggings of Birch creek were established. Circle City, the emporium for Birch creek, and the town of Fortymile divided between them until 1896 all the provisions that could be taken into the country, and there was not enough to support the numbers then mining, a goodly percentage of whom had to make their way out each fall, live the winter in the cities along the western coast, and re-enter in the spring.

In 1896 gold was found in abundance in the world-renowned Klondike district. This led to the almost entire abandonment of the Circle City and Fortymile districts, and now, whether they will or no, the companies trading there have to deposit all their provisions at Dawson City, the emporium for the district.

As to the distribution of gold through the territory, it may be stated generally that gold is found pretty well all over the upper part of the Yukon basin, and in a good part of the lower end of it as well. The basin of the Yukon comprises within its bounds, as far as known, about 338,000 square miles of territory, with about 3200 miles of navigable river. Of this area nearly 150,000 miles, a little less than half, is British territory, and of the navigable stream over 1300 miles. The British end of it yields about 6000 miles of river, stream, and gulch. The other streams, not confluent to the Yukon, will increase this length to about 7000 miles. Now it may be said that almost everywhere in this area gold

LOOKING DOWN WHITE HORSE RAPIDS.

(97½ *miles from head of Lake Bennett.*)

BREAK-UP OF ICE ON THE YUKON RIVER.

FORTY-MILE RIVER

(*where the International Boundary crosses it*)

CONFLUENCE OF THE YUKON AND FORTY-MILE RIVERS.

(40 *miles above International Boundary.*)

has been found where prospecting has been done—true, in some places in very limited quantities; but in many places in quantity sufficient to well reward individual effort. Others sites will not pay at present, but, under improved conditions of transport and reduced wages, will yield a fair income. To put it in another way—of these 7000 miles of river, stream, and gulch, we can safely assert that at least one-half yields gold. Much of it, we know, yields it in paying quantities. Of these 3500 miles, at present we know that only about 200 have been tested and developed, and, possibly, 400 or 500 located are in part tested. Indications point to rich diggings yet to be discovered. We cannot positively assert that they will be; neither can we deny it; but we can positively point to upwards of 3000 miles of stream and gulch which are likely to yield good returns to investors or individual effort. So much for placer or alluvial deposits of gold, which may be characterised as the individual's mine.

Gold-bearing rock, locally named quartz (we will not discuss its lithological character), has been discovered and located at some nine or ten points in the Fortymile and Klondike areas. Many of these lie close together. Nearly all of the reefs are very extensive, and all, with one exception, are low grade, yielding from 24s. to 25s. per ton to 45s. to 50s. per ton, averaging possibly 30s. to 35s. a ton. One of these is close to the mouth of Fortymile river, and is so extensive that it will take a goodly sized stampmill generations to exhaust it. Two other locations, about thirty-five miles farther up the Yukon river, may be characterised in the same words. These three will possibly return between 30s. and 40s. to the ton of rock. The others have not yet been assayed; consequently we are unable to speak with any authority about them. One small exposure found on the bank of Hunker creek yielded, to a very crude assay, from 100 dollars (£20) to 1000 dollars (£200) per ton of rock. Unfortunately at present we are unable to say whether this is of sufficient extent to justify attempts at development, and we are further unable to say whether the gold found in the rock is the result of deposit by stream or not. The rock stands on the bank of Hunker creek, part of it under the waters of the stream, and it may be—indeed it has been suggested—that the gold found in it is only superficial, and is the result of deposit by the waters of that stream. This has yet to be determined.

Prospectors along the entire length of Stewart river predict rich finds of quartz lodes on that stream, as quartz is found in the gravel wash. A few thin veins have been found along its banks associated with black shale. It may be said, however, that no attempt has been made at quartz location. The miners now in the country, with very few exceptions, fully employ their time in search for placer diggings. They all know very well that at the present time quartz lodes are valueless, for the reason that the present freight facilities will not permit of the introduction of mining machinery, such as is required for the development, even on a small scale, of quartz or reef mines. It cannot reasonably be claimed that the vast area where this rock is found is entirely denuded of all the gold in it. If this is not the case, many of the lodes whence the placer gold was derived exist, in part at least, in the ridges between the various

streams and gulches, and it is only a question of time and search when some of them will be found; and out of so many hundred chances it might surely be claimed that some of them will well repay development. The conditions existing there are much against easy quartz prospecting. The surface in the valleys is covered with a thick coat of moss. This again supports a dense growth of furze and shrubbery, through which we find scattered a rather thick growth of scrubby forest. Such is the vegetation until we reach altitudes of nearly 2000 feet above the river, or 2500 or 3000 feet above the level of the sea, where we come to the limit of the timber. But above this an Arctic shrubbery exists, which is almost as serious a hindrance to rock examination as what exists below, and it is only on the tops of the highest ridges, which are exposed to the fierce winds generally prevailing in that region, that we find any extensive rock exposure. Heretofore these ridges have only been visited by miners making their way from one stream to another, and as the wind blowing there is, even in the middle of summer, very often rather cool, they do not make unnecessary delays, but hurry down to more congenial temperatures and better shelter. These causes all combined have prevented, and will largely hinder in the future, all except well-organised and well-directed search. A small diamond drill plant would, I think, prove a cheap, expeditious, and satisfactory means of prospecting for quartz lodes. It can be set up anywhere, and manipulated by hand if necessary, and the core taken out will show the character of the rock, on the surface at least. Quite a large area could be successfully tested in a single season. Of course an expert would see at once, from the character of the rock, after the first foot or so had been bored, whether further attempt would be likely to prove successful or not.

Again, from the fact that all the streams in the country are covered with ice for nearly seven months in the year (from the 1st of November until the middle of May on the large streams, and from, it may be asserted, the 1st of October until the middle of May on the smaller ones), quartz mining or milling could not be economically carried on during more than five months or so in the season—that is, by the methods now employed. This will necessitate a modification of present methods, and some process of dry or semi-dry milling, as is respectfully suggested in all my reports and all my addresses on that region. How this may be accomplished time will determine. At present many methods are proposed; and as the attention of experts and those contemplating mining there has been called to these conditions, many ways have been thought out of overcoming the obstacles. How far they will succeed it is impossible at present to say. Several of them look like success, and possibly with a little experience success will be the result. When fuel is required it will be found in abundance, and at many points quite near to the quartz lodes. Coal is found at many points along the Yukon river. At some points it is exposed on the bank, at many others within a few miles of it, so that, when the necessity arises for its use, it will be a simple matter to procure it and lay it down at whatever point it may be wanted. Timber is only found in the river valleys, and there, too, quite near to the banks of the streams. A short distance away

METEOROLOGICAL RECORD IN THE YUKON DISTRICT.

Year.	Month.	TEMPERATURE. Mean Minimum.	Mean Maximum.	Highest.	Lowest.	NUMBER OF TIMES. 32 degs. and below.	Zero and below.	-10 degs. and below	-20 degs. and below.	-30 degs. and below	-40 degs. and below.	-50 degs. and below.	-60 degs. and below.	REMARKS.
1887	Aug.	39·9 degs.	...	...	21·6 degs.	4								
	Sept.	31·7 ,,	...	...	16·0 ,,	18	...	...	...	...	...	...	...	First snow on the 23rd.
	Oct.	18·5 ,,	...	...	4·0 ,,	31	...	...	...	...	...	...	...	First ice running in river on 21st.
	Nov.	- 5·1 ,,	...	...	24·1 ,,	30	22	12	3	...	...	...	...	Ice set in river on the 15th.
	Dec.	-33·6 ,,	27·6 degs.	10·5 degs.	55·1 ,,	31	31	29	26	19	14	4		
1888	Jan.	-25·3 ,,	-15·3 ,,	13 0 ,,	-53·5 ,,	31	27	23	19	16	7	3		
	Feby.	-16·8 ,,	4·3 ,,	24·2 ,,	52·7 ,,	29	24	17	11	7	6	1	...	No readings were taken on 3rd, 4th, 6th, 7th, and 8th.
	March	11·5 ,,			52·7 ,,	26	19	13	6	5	4	1	...	,, ,, ,, 11th.
	April	-20·4 ,,			-37·7 ,,	29	28	23	13	7	...	...	...	Max. Temp. was not taken on the 3rd.
	May	19·8 ,,	43·3 ,,	55·0 ,,	- 1·8 ,,	30	1							
1895	Aug.	40·1 ,,	...	...	28·0 ,,	6	..	...	...	...	...	...	...	No readings were taken from 1st to 9th.
	Sept.	30·9 ,,	...	...	21·5 ,,	18								
	Oct.	19·4 ,,	...	...	-12·7 ,,	29	1	1						
	Nov.	4·2 ,,	11·9 ,,	38·5 ,,	-36·3 ,,	30	12	3	1	1	...	...	...	Ice set in river on 22nd November.
	Dec.	-18·2 ,,	-13·8 ,,	6·0 ,,	55·4 ,,	31	29	20	10	6	3	1		
1896	Jan.	-41·9 ,,	-33·0 ,,	6·0 ,,	-67·9 ,,	31	31	29	25	24	15	12	5	
	Feby.	25·5 ,,	-11·6 ,,	32·0 ,,	-64·8 ,,	29	27	24	16	11	10	2	2	
	March	- 2·4 ,,	18·1 ,,	39·5 ,,	-37·3 ,,	31	20	6	3	1				
	April	2·0 ,,	24·0 ,,	49·0 ,,	-28·4 ,,	28	15	10	8					
	May	28·8 ,,	48·7 ,,	62·0 ,,	5·0 ,,	18								
	June	39·8 ,,	65·1 ,,	80 0 ,,	27·8 ,,	4								
	July	44·5 ,,	68·9 ,,	81·0 ,,	33·0 ,,									
	Aug.	42·1 ,,	62·6 ,,	76·0 ,,	27·2 ,,	2								
	Sept.	34·3 ,,	50·5 ,,	63·0 ,,	4·8 ,,	8								
	Oct.	20·2 ,,	32·9 ,,	51·0 ,,	- 1·0 ,,	27	2							
	Nov.	-14·7 ,,	- 6·0 ,,	22·5 ,,	-38·0 ,,	30	23	18	13	7				
	Dec.	-17·4 ,,	- 6·5 ,,	11·0 ,,	-44·5 ,,	31	28	19	11	7	2			
1897	Jan.	-24·0 ,,	-14·0 ,,	10·0 ,,	-55·6 ,,	31	27	21	16	13	9	6	...	No readings were taken for Max. Temp. on 6th, 7th, 8th.
	Feby.	-12·3 ,,	0·6 ,,	31·0 ,,	-36·0 ,,	28	23	14	9	2	...	...	...	,, ,, ,, ,, ,, on 16 days.
	March	-14·7 ,,	...	...	-54·3 ,,	30	21	15	12	8	5	3	...	,, ,, ,, on the 28th.
	April	18·1 ,,	...	...	- 5·0 ,,	27	1	...	...	...	...	...	...	,, ,, ,, ,, 4th and 5th.

from the water the frozen ground prevents the proper development of trees. The season during which they can grow is very short, and the ground on which they grow is continually frozen. These conditions result in the growth of trees from three to six inches in diameter, which are found to be several centuries old, if we count the growth-rings, one of which generally stands for a year's growth. All commercial timber will necessarily soon become exhausted, and the sooner coal-mining is taken up the better for all concerned. This offers a safe investment to capitalists.

Other minerals are found in limited quantities in the Yukon country: galena, near Fortymile, yielding upwards of thirty oz. of silver per ton of ore; a crude form of asbestos occurs in the same vicinity; copper on White river, and traces of it at several points along the Lewes. Silver has been found in the drift on some of the streams near the head of the Lewes, and it has been declared that an extensive lode of silver ore has been found in the vicinity of Bennet lake. All these conjoined go to show that the future of that country will be much more bright and cheerful than its gloomy, inhospitable surface and long, cold, dark winters would at present indicate. There is a vast field here for a reasonably safe investment of British capital and influence; and attention is cordially invited to it by the people of Canada, not the least part of this vast Empire.

The preceding compilation from my records of temperature convey an idea of the range of temperature, and duration of the seasons. It can truthfully be said that while it is cold it is not unhealthy, nor so disagreeable as might be thought from the low thermometer readings shown.

THE TUNDRAS AND STEPPES OF PREHISTORIC EUROPE.

By Professor James Geikie, D.C.L., LL.D., F.R.S.

(*Continued from page* 294.)

(*With a Map.*)

II.[1]

In my preceding lecture evidence was adduced to show that tundras and steppes, with their characteristic faunas, formerly existed in Central and West-central Europe. We saw that for a long time the climatic conditions of these regions must have resembled those that now obtain in Northern Siberia and the barren grounds of North America, where mosses and lichens form the prevailing growths, and arctic lemmings, hares, and foxes, the reindeer, and the musk-ox, are the common indigen-

[1] A Lecture delivered before the Royal Dublin Society, 11th March 1898.

ous animals. All these characteristic species formerly lived in Middle Europe. Eventually our tundra flora and fauna gradually disappeared and were as gradually replaced by steppe forms of life. Jerboas, pouched marmots, pika, and many others—such an assemblage as we now see in the sub-arctic steppes of south-east Russia and south-west Siberia—flourished throughout the regions over which the lemmings and their arctic congeners had formerly prevailed. Throughout both tundra and steppe epochs Palæolithic man was an occupant of Middle Europe. To the steppe epoch succeeded a forest epoch, with its characteristic fauna, by which time Palæolithic man had vanished, his place being taken by the so-called Neolithic race, or races, for there were several of these.

We must now ask what relation the tundra and steppe deposits bear to other well-known superficial accumulations of Europe. To what particular stage of the geological history of our continent do they belong? When we remember that an arctic-alpine flora formerly flourished on the low grounds of Central Europe, it seems extremely probable that the tundra epoch must fall within the Glacial Period. But the Glacial Period embraced a complex series of geographical and climatic changes, and it is necessary, therefore, to come somewhat closer to the question. Among the most conspicuous deposits of the Ice Age are moraines of all kinds and fluvio-glacial gravels, while the löss, as we have seen, is the most prominent accumulation of the tundra and steppe epochs. How, then, does the latter behave with regard to the typical glacial and fluvio-glacial formations? Is it older or younger than these, or are the two sets of accumulations contemporaneous? The answer we get to that question is, at the first blush, disconcerting, for we learn that it is each in turn—sometimes underlying, sometimes overlying, and in other places occurring intercalated amongst glacial deposits. This only means, however, that löss appears to have been formed during different stages of the Ice Age. It will be remembered that while we discussed the wind-blown character of the löss, we left untouched the question of the origin of its materials. Whence were those materials derived which the wind worked over, and largely re-arranged, and re-distributed in the low grounds of Central Europe? To answer this question we must examine more closely the relation borne by the löss to the fluvio-glacial deposits and morainic accumulations. We note, in the first place, that in its horizontal distribution it follows closely that of the valley-gravels of glacial times. Where the latter are well developed, the löss appears in full force; where they are wanting there is a like absence of löss. In all the valleys leading down from the Alps to the low grounds of Middle Europe the löss puts in a prominent appearance. It obviously bears a close relation to the main lines of drainage, and may be said to be confined to valleys that head in formerly glaciated areas. So again, in North Germany and Southern Russia, it spreads over all the low-lying tracts that lay in front of the vast *mers de glace* of glacial times. These facts alone, taken in connection with the occasional well-stratified character of the löss, the intercalation in it now and again of beds of sand, and the presence ever and anon of freshwater shells, seem strongly suggestive of a fluviatile origin. And that such was really the origin of the

materials of the löss will appear clear enough when we consider the conditions that obtained during a glacial epoch. (*See* Map A.)

While all Northern and North-western Europe were covered by an ice-sheet, the mountains of Middle Europe and the Alpine Lands supported great glaciers, which in many cases deployed upon the low grounds. Vast bodies of water must then have escaped from the terminal front of the northern *mer de glace*, while the streams and rivers flowing from our mountain tracts must have greatly exceeded their present successors. With each recurring spring and summer wide areas in the low grounds would thus be subject to floods and inundations. Coming from regions where glacial grinding was being carried on upon a most extensive scale, it goes without saying that all these waters would be clouded with the fine flour of rocks. The enormous morainic accumulations formed underneath and in front of the Alpine glaciers, and over the vast areas traversed by the Scandinavian *mer de glace*, bear emphatic testimony to the intensity of glacial erosion. In like manner the great terraces of gravel that stretch down the valleys in front of the Alpine moraines and the broad sheets of similar deposits which extend outwards from the glaciated tracts of Northern Europe, are equally impressive witnesses to the vigour of the flooded glacial rivers. It is certain, however, that gravel, grit, and sand would not be the only materials carried forward by those rivers. As they reached the low-lying tracts their rate of flow would gradually diminish, and finer-grained materials—fine silt and loam—would eventually be deposited. When we consider the great volumes of water descending to the low grounds, we cannot, indeed, escape from the conclusion that many wide areas in the plains during a glacial epoch must have been inundated, and in those slack-waters and temporary lakes the finer-grained fluvio-glacial sediments would tend to accumulate. We must also bear in view the probability—I had almost said the certainty—of great derangements of the drainage having taken place in Middle Europe. In winter, when the rivers of that region were frost-bound, snow must frequently have drifted to great depths in the valleys, and the spring and summer thaws would often fail to remove these heaps. In this way the valleys might here and there become entirely filled with the blown and congealed snows of successive years, so as to compel the rivers in summer to rise in flood, and to reach levels which they might otherwise have been unable to attain. We have positive proof, indeed, that such accumulations of drift-snow actually did appear in extra-glacial regions, for some of them have persisted to the present day. The ice-formations of the Arctic coast-lands, with their associated mammalian remains, certainly belong to the Glacial Period. They are simply the drifted snows, now converted into granular and massive ice, which accumulated in valleys and depressions outside of the glaciated regions. Protected under a covering of superficial detritus, alluvial matter, and peat, they have in those high latitudes persisted to the present day. Farther south, in Central and Western Europe, similar masses of congealed snow, as we have seen, appear to have accumulated, and may well have endured for some time after glacial conditions had passed away. In these temperate latitudes,

however, they were bound ere long to melt, and allow the overlying alluvial deposits to settle down in the manner already described.

There are thus various lines of evidence which lead to the conclusion that during a glacial epoch the lower reaches of all the great valleys opening out from glaciated regions, as well as large tracts of the wide plains extending in front of the northern *mer de glace*, would be more or less drowned in temporary lakes of turbid water, over the beds of which a fine sediment of somewhat uniform character must have been deposited. And such is generally believed to be the origin of the materials of the löss. The löss, as we now have it, is a fluvio-glacial silt or loam, very largely re-assorted and re-arranged by the wind. Its history, therefore, is involved with that of the Ice Age, and we must consequently turn our attention to the unquestioned deposits of that period, with a view to discover, if we can, at what particular stage of it the glacial silts were worked over by the wind, and tundra and steppe faunas successively occupied the low grounds of Middle Europe.

Let us first, then, trace as briefly as may be the history of the glacial and interglacial deposits. Avoiding detail, we shall confine attention to the more salient features of the evidence, and try to picture the succession of events from the beginning to the close of glacial times.

The facts upon which geologists base their conclusion that a vast ice-sheet formerly covered much of Northern and North-western Europe, while great snow-fields and glaciers existed not only in the Alps, but in many of the minor mountain ranges of Central and even of Southern Europe, may be very briefly summed up.

First, we have the evidence supplied by morainic accumulations of all kinds—bottom moraines or boulder-clays and terminal moraines. Second, we have the proofs of former glaciation afforded by striated rocks and *roches moutonnées*, and by the crushed, broken, tumbled, and confused rock-surfaces that occur so frequently underneath the bottom or ground moraines. Third, we have the presence of certain remarkable ridges of gravel and sand which appear to have been formed in tunnels under the ice, and of enormous sheets of similar materials which have been spread out by the waters escaping from the terminal front of the inland ice of Northern Europe; while in all the great valleys leading down from the Alps and other glaciated mountains we see broad terraces of alluvial detritus which have been deposited by torrential streams and rivers. All those fluvio-glacial deposits when followed from the low grounds into the regions occupied by moraines are found to dovetail with the latter, and are consequently of contemporaneous origin.

By mapping rock-striæ and noting the general trend of the erratics which constitute so large a portion of the ground moraines, we acquire a knowledge of the directions followed by the inland ice and the great glaciers. Not only so, but by tracing the horizontal and vertical distribution of glacial phenomena, we have been able to show what regions were wholly ice-covered, to measure the thickness attained by ice-sheets and glaciers, and to estimate the angle of their surface-slope. It is, in short, quite possible now to draw maps of Europe which shall give a fairly accurate presentment of the aspect presented by our continent in

glacial times. On maps of a sufficiently large scale, we can delineate not only the great inland ice of the north and north-west, but the snow-fields and numerous glaciers of the Alps and other mountainous tracts, together with the areas covered by fluvio-glacial deposits.

So much for what we may call the physical evidence. But this is not all, for associated with the true glacial accumulations occur in many places beds charged with the remains of arctic-alpine plants and animals. The evidence of fossil organic remains, therefore, fully supports the conclusions arrived at from a study of purely glacial phenomena. We know that arctic forms of life lived in our seas at the time of which I am speaking, and that the countries outside of the glaciated areas were then clothed and peopled by an arctic-alpine flora and fauna.

But, as if in contradiction of this evidence, certain other deposits, charged with the remains of temperate and southern species of plants and animals, appear intercalated among the true glacial accumulations. The study of these and of their relation to subjacent and overlying morainic and fluvio-glacial accumulations, has led to the conclusion that the Glacial Period was not one continuous period of arctic conditions, but a cycle or succession of alternating cold and genial epochs.

So far as we at present know, glacial conditions first supervened in late Tertiary times—in the so-called Pliocene Period. In the earlier part of that period the European climate had been singularly genial. Warm seas, tenanted by many southern species of molluscs, washed the shores of the British area, while the land was clothed with a much more varied and abundant flora than we now possess. Great forests seem to have covered vast areas, occupying not only the plains and the river valleys, but extending far up the mountain slopes of such regions as France without much change of character. The same species indeed appear to have flourished equally well in Cantal and Central Italy. Some of these had come down from early Tertiary times, and were destined soon to become extinct; some again were special forms belonging to genera which in our day are exotic; others were species which have survived to the present in more southern and eastern regions: while yet others are still represented in Europe by identical or very closely allied species. Thus the flora of the Pliocene was connected both with the past and the present plant-life of Europe, while at the same time it had relations with the floras of distant southern and eastern regions—with Florida, the Canary Islands, China, and Japan. All the evidence thus implies for early Pliocene times an equable and uniform climate, which permitted the intimate association in our continent of many plants, which are now no longer able to exist at similar elevations, or in one and the same latitude.

The mammalian life of Europe in early Pliocene times was in keeping with the flora. The deinotherium and mastodon still survived, and along with these were rhinoceroses, hippopotamuses, and elephants, and many cervine and bovine animals. Carnivores of extinct and still existing types and many monkeys were also present.

Such then was the character of the climate, and the aspect of the flora and fauna of Europe in pre-glacial times. The gradual approach of glacial conditions is evidenced by the fact that the percentage of northern

and arctic shells in the upper Pliocene marine deposits increases from the lower to the higher members of the series. We note a gradual dying-out of southern species, and a gradual coming-in of northern forms, until at last the beds are charged with the remains of a truly arctic marine fauna. We have no direct evidence as to the terrestrial conditions which obtained in Britain and Ireland at that time. The climate, however, could not have been genial and temperate as it is now. The presence of an arctic fauna in our seas shows that our shores were washed by currents coming from the north, and not as at present from the south-west. Reasoning from the analogy of to-day, therefore, we might infer that the climate of our area was probably not unlike that of Labrador.

The traces of the first glacial epoch are more clearly read in the deposits of the continent. An immense glacier at this time, fed from the uplands of Scandinavia, filled the basin of the Baltic. The bottom moraine of that great ice-flow is seen in the low grounds of Scania, in Southern Sweden, while its fluvio-glacial deposits have been detected at many places in North Germany. The Alpine Lands were contemporaneously covered with extensive snow-fields, and large glaciers descended the deep mountain valleys, to deploy upon the *Vorländer*, in Switzerland, and South Germany. The terminal moraines of these glaciers have been mapped out, and the general conditions of the epoch have been so well ascertained, that the position of the snow-line at the time has been determined. It is believed to have been upon an average some 4000 feet lower than now. While the valleys of the Alps were thus gorged with ice and the basin of the Baltic was occupied by an immense *mer de glace*, it is not probable that the higher parts of our islands could have escaped glaciation. We can hardly doubt that snow-fields and glaciers must also have existed here. No trace of these, however, has been or is ever likely to be detected. Direct evidence of the kind, if it ever did obtain, has been obscured or destroyed by the action of the much greater glaciers and ice-flows of later epochs.

In tracing the succeeding events in the geological history of Europe, I shall confine attention in the first place to the Alpine Lands, for it is in the low grounds at the base of those mountains that the relation of the löss to the glacial and fluvio-glacial deposits can be most clearly made out.

It has now been ascertained that glaciers have on three successive occasions filled the great mountain valleys of the Alps and descended to the low grounds. The earliest advance I have already described—this constitutes the first glacial epoch of Swiss geologists. It was followed by a long spell of genial conditions when the great glaciers melted away, and retired to the inner recesses of the mountains. Many relics of the flora of this genial epoch have been preserved. Thus in the valley of the Inn, near Innsbruck, certain deposits have yielded an assemblage of plants similar to that which we now meet with in the valleys of the mountain regions south of the Black Sea—most of the plants being existing species. The mean annual temperature of the regions in which that flora now flourishes is 57° to 65° F., while that of Innsbruck at present is only 47°. But in the genial epoch of which I speak, the flora in question flourished

on the mountain slopes overlooking Innsbruck at elevations of 3600 to 3900 feet, where the mean annual temperature in our day does not exceed 40°. This is enough to show us that the climatic conditions of the Alpine valleys must formerly have been considerably more genial than at present. From this and similar evidence in other Alpine valleys we may safely infer that the retreat of the glaciers was the result of a great change of climate, and that during the first interglacial epoch the snow-fields and glaciers must have retired to the highest ridges of the mountains.

The plant-beds just referred to are not only underlaid but overlaid by bottom or ground moraines, the overlying moraines belonging to the second glacial epoch. It was during this epoch that the glaciers of the Alps attained their greatest development—the snow-line becoming depressed to 4700 feet below its present level. The glaciers now pushed their way into the low grounds considerably beyond the limits reached by their predecessors in the first glacial epoch. That the second, like the first glacial epoch, was of long duration is shown by the amount of erosion effected by the ice-flows, and the enormous extent of their bottom and terminal moraines.

Overlying the ground moraines of that epoch we again come upon alluvial deposits in many places, which are crowded with the remains of a temperate flora—a flora resembling that of the low grounds of Switzerland and North Italy in our own days. It is obvious, therefore, that when such a flora flourished in the great valleys of the Alps the climate could not have been less genial than the present: the snow-line must have again retreated to a higher level, and the névés and glaciers were probably not more extensive than they are now. This constitutes the second interglacial epoch of Swiss geologists. Ere long it was followed by a third general advance of the glaciers, which once more reached the low grounds at the base of the Alps, but did not flow so far as their predecessors of the preceding or second glacial epoch. The snow-line of this third glacial epoch stood at an average level of about 4400 feet below the present.

Each glacial epoch was necessarily marked by profound glacial erosion, and the consequent formation of massive sheets of ground moraine in the lower reaches of the great valleys, and of huge terminal moraines at or opposite their mouths. Enormous quantities of shingle and gravel were at the same time swept outwards by the rivers escaping from the ice—each series of terminal moraines being thus closely associated with its separate and distinct set of fluviatile deposits. No difficulty is found in separating those successive accumulations of gravel. They form terraces lying one within the other at three successive levels. The highest rises upon an average 250-300 feet above the present rivers; the surface of the middle terrace is about 100 feet below the surface of the highest, and about the same distance above the level of the lowest terrace. Each terrace rests upon solid rock, and it is obvious, therefore, that the several epochs of gravel accumulation have been separated by epochs of active river erosion. This remarkable valley-within-valley formation is clearly the result of climatic changes. The highest terrace indicates the action of flooded rivers escaping from the glaciers of the first glacial epoch.

These glaciers then disappeared, or shrank into comparative insignificance, and an interglacial epoch of active valley erosion succeeded—the rivers cutting their way down for a hundred feet or more into the solid rocks. Next came the second glacial epoch, and the lowered valley-bottom was again deeply covered with gravel. The glaciers of this stage then in their turn retired, and a second interglacial epoch supervened, when the rivers as before deepened their channels, working down through the older gravels, and excavating the underlying rocks. Thereafter the third glacial epoch ensued, and a new series of gravels was deposited at a lower level than the preceding accumulation. Lastly, this third glacial epoch passed away, and the rivers again trenched the fluvio-glacial gravels, the upper surface of which is now much above the reach of the greatest floods.

What relation, then, does the löss bear to the glacial and interglacial accumulations of the Alpine Lands? Fortunately to this question a definite reply can be given. It is dovetailed with the glacial deposits in such a manner as to show that its formation has taken place at successive epochs. Thus it occurs occupying an interglacial position between the accumulations of the first and second, and between those of the second and third, glacial epochs. When we pass down the valley of the Rhine a similar succession is encountered. In the wide plain lying between the Vosges and the Black Forest, löss is met with on the same geological horizons, overlying the gravel-terraces of the first and the second glacial epochs. Not only so, but even the youngest or lowest gravel-terrace (that of the third glacial epoch) is in like manner sheeted in löss. The löss on these three separate horizons is for the most part wind-blown, and exactly resembles that of Middle Europe generally, showing the same structure and arrangement, and containing a similar assemblage of organic remains.

To what extent each of these "horizons" of löss may be represented in the low grounds of Middle Europe we cannot definitely say. But as the materials of the löss are for the most part of fluvio-glacial origin, it is obvious that such accumulations must have been formed during each successive advance of the Alpine glaciers. As each glacial epoch passed away those accumulations were greatly modified by the wind, and drifted into the valleys that drain the Alps, where they were subsequently covered and to some extent preserved under the morainic and fluvio-glacial deposits of the succeeding epoch of glacial advance. It seems probable, therefore, that the wind-blown löss of the low grounds of Middle Europe does not belong exclusively to any one particular stage of the Glacial Period. It is impossible, however, at present to divide it up into separate stages. But we may feel sure that if tundra and steppe faunas succeeded each other again and again in the valley of the Rhine, they could hardly fail to have done the same in the wide plains of Middle Europe.

It will be remembered that at the Schweizersbild, the deposits containing remains of tundra and steppe faunas rest immediately upon fluvio-glacial gravels. These gravels were laid down during the third glacial epoch. It is quite certain, therefore, that the faunas referred to

must have entered Switzerland after the retreat of the glaciers from the low grounds. But how long an interval may have elapsed between the disappearance of the glaciers and the advent of the lemmings and their congeners we cannot tell. All we know is that after the appearance of the tundra fauna in Switzerland, the climate, at first cold and arctic, gradually became less extreme, so that in time a steppe fauna, and afterwards a forest fauna, succeeded. In other words, no perceptible hiatus separates the present from the conditions that obtained when the reindeer hunter vanished from the Alpine Lands. He was succeeded by Neolithic man, just as the latter was followed by the men who used bronze and iron implements and tools. So far as the evidence of the Schweizersbild rock shelter is concerned, we should infer that no great alternations of cold and genial epochs followed after the final retreat of the great glaciers of the third glacial epoch. But, as we shall see presently, the tale told by that interesting rock shelter is incomplete. Certain considerable climatic changes did take place after the third glacial epoch had passed away. The evidence of such change, however, though not wanting in the Alpine Lands, is much more clearly displayed in North-western Europe. To the testimony yielded by the glacial and interglacial deposits of that region, therefore, we shall now direct attention.

It will be remembered that during the first glacial epoch a great Baltic glacier existed, and an arctic fauna lived in the North Sea. That epoch was succeeded by the first interglacial stage, when the southern part of the North Sea became dry land, and England was occupied by an abundant mammalian fauna—comprising hippopotamus, elephants, rhinoceros, horse, bison, boar, many kinds of deer, and a number of carnivores, including bears, hyæna, sabre-toothed tiger, wolf, fox, etc. The contemporaneous flora was temperate, resembling very much that which now exists in south-east England. In similar latitudes on the continent the same mammalian fauna flourished, while the flora was temperate, but suggestive of less strongly contrasted summers and winters than the present. A kind of insular climate, in short, seems to have characterised North Germany.

To this genial interglacial epoch succeeded the second and most extreme of all the glacial epochs. An enormous *mer de glace* then extended over all Northern and North-western Europe, from the British area in the west to the Urals in the east, and from Lapland in the north to the mountains of Middle Europe in the south. (*See* Map B.)

When these extreme conditions eventually passed away, the second interglacial epoch supervened, characterised, as the earlier one had been, by a genial temperate climate, by the presence in England and the continent of the great pachyderms and their congeners, and by the appearance of Palæolithic man.

This second interglacial epoch was in its turn succeeded by a third advance of the Scandinavian "inland ice," which once more coalesced with the *mer de glace* of the British area. It did not, however, flow so far as its predecessor. Nevertheless it reached the Valdai Hills in the east, the valley of the Elbe in the south, and covered all Scotland, the

north of England, and the major portion of Ireland. This ice-flow was most probably contemporaneous with the third advance of the great glaciers of the Alps. (*See* Map C.)

It is noteworthy that the löss in North Germany nowhere overlies the morainic accumulations of the third glacial epoch. It does, however, cover the marginal area of the ground formerly invaded by the second and greatest *mer de glace*. This clearly shows that the löss of North Germany must belong, in part at least, to the second interglacial epoch. The fact that it everywhere avoids the regions over which the third great ice-sheet prevailed, does not, however, prove that tundra and steppe conditions did not supervene at a later date in Middle Europe. The evidence supplied by the Alpine Lands, and the great valleys that drain those lands, is quite conclusive of the contrary. There is no doubt whatever that the Palæolithic reindeer hunters followed the chase in Middle Europe long after the third great Scandinavian *mer de glace* had retired from the plains of North Germany. The geographical distribution of the wind-blown löss shows that steppe conditions were restricted to a broad belt of land in Middle Europe. These conditions were rendered possible by the former greater extension of our continent into the Atlantic, when the major portion of the North Sea and the English Channel were dry land, and the British Islands formed part of the continental area.

Considerable climatic changes continued to take place after the passing of the third glacial epoch. These have left their traces in the Alpine Lands, but they are nowhere so clearly seen as in Northern and North-western Europe. Temperate conditions supervened in North Germany—the flora and fauna closely resembling those of the present. But eventually a relapse to glacial conditions followed, and from the Scandinavian snow-fields another invasion of North Germany took place. Norway, Sweden, and Finland were now once more shrouded in ice, and a great Baltic glacier came into existence, the gigantic terminal moraines of which are met with in Denmark, Schleswig-Holstein, and Prussia. The Scottish Highlands and other mountainous parts of the British Islands at the same time nourished local ice-sheets and large valley glaciers, which in many cases descended to the sea. The Alpine Lands in like manner witnessed a recrudescence of glaciation, large glaciers flowing into the great longitudinal valleys, but nowhere deploying as before upon the low grounds. It is to this stage, probably, that we should assign the tundra fauna of the Schweizersbild. (*See* Map D.)

The succession in that interesting rock shelter has shown that as the severity of the climate relaxed, steppe and forest faunas successively followed the disappearance of the tundra forms. The climate of Europe generally became temperate, and immense forests overspread wide regions. It was during the approach of these conditions, as we have seen, that Palæolithic man seems finally to have vanished, and the Neolithic races to have made their earliest appearance in Europe. The British Islands at this time formed part of the continent, and the Baltic existed as a great freshwater lake. The lower buried forests of our peat-bogs are among the conspicuous remains of this stage. Eventually, however,

submergence ensued, the British Islands were severed from the continent, and the sea again invaded the Baltic basin. It is notable that the character of the marine fauna which at this stage lived off the coasts of Scandinavia and Britain is indicative of more genial conditions than now obtain. The climate, however, gradually became colder, the vertical and horizontal range of the forests was restricted, and snow-fields again appeared among the higher mountains of our islands. In Scotland glaciers here and there came down to the sea, and dropped their moraines upon the beaches then forming; the large majority, however, terminated inland. At that time the snow-line in North Britain ranged between 2000 and 2600 feet. Similarly, in Norway and in the Alps an advance of glaciers took place—the snow-line in Southern Norway being about 2400 feet, while in the Alpine Lands it seems to have averaged 7500 feet, or some 1600 feet lower than the present.

Later climatic oscillations followed, but on a decidedly reduced scale. The effect of these was naturally enough most marked in North-western Europe, decreasing gradually southwards, and doubtless eventually fading away in the lower latitudes of the continent. It is not necessary for my present purpose to do more than briefly indicate the general character of these later changes so far as they affected our own area.

The local glaciers of the British mountains, some of which, as I have said, actually entered the sea, at last began to retreat. The climate became more genial, and so once more favoured the growth of forests, which in many places began to overspread the now dry peat-bogs, beneath which the trees of the earlier forest epoch lay entombed. Eventually, however, colder and more humid conditions returned, and small glaciers appeared in a few places amongst the loftiest heights of the Scottish Highlands. The position of the moraines of these glaciers indicates a height of 3500 feet for the snow-line. The forests now, as before, began to decay in many places, and the bog-moss and its allies again extended in all directions, and so, eventually, a second forest-bed became entombed in growing peat. It is needless to say that the evidence of these later changes is not restricted to Scotland. The bogs of the two sister countries, and of the corresponding latitudes on the continent, present us with precisely the same phenomena.

The present decayed aspect of the bogs in many places where they formerly flourished, and the fact that certain plants and groups of plants are once more beginning to invade such wastes, shows that we are now living under somewhat milder and less humid conditions.

Although these later climatic oscillations certainly affected the distribution of plants and animals to some extent in Northern and North-western Europe, yet the changes brought about were insignificant as compared with those which characterised the alternations of preceding glacial and interglacial epochs. The earlier cold and genial stages were strongly contrasted, and marked by great migrations of flora and fauna. But, as the strange cycle drew to a close, the contrast between glacial and interglacial phases became less and less pronounced, and gradually faded away into the present. The steppe fauna vanished from Middle Europe during the fourth interglacial epoch, and it never returned. The

climatic oscillations that followed were on too small a scale to induce great migrations, and thus the succeeding forest fauna retained its place. Hence in such a section as that seen in the rock shelter of Schweizersbild, we find no recognisable evidence of the climatic changes to which the buried forests and peat-bogs and the small local moraines of Northern and North-western Europe bear testimony. It is thus only by correlating and comparing the evidence over the widest area that we are able to get the story completed.

In fine, we have seen that tundras and steppes appeared at successive epochs in prehistoric Europe. The former were contemporaneous with the great ice-sheets and glaciers, while the latter came into existence when glacial conditions were passing away. The tundra and steppe conditions of our continent belong, in short, to that remarkable cycle of climatic and geographical changes known as the Ice Age or Glacial Period. Palæolithic man undoubtedly lived through both phases, for his relics and remains are found associated alike with the arctic lemmings and the succeeding steppe animals. Whether the reindeer hunter of Middle Europe ever came into contact there with Neolithic man we cannot tell. Were we to trust to negative evidence we should say he never did. But negative evidence cannot be trusted. It is quite possible that the two races may have met and even commingled, but of this no proof is forthcoming. The strong hiatus that separates the Old Stone and the New Stone epochs in Western and North-western Europe has not yet been bridged over in Middle and Southern Europe. When last we see Palæolithic man he is hunting the reindeer and the mammoth in the Danubian steppes. His Neolithic successor seems not to have appeared in Middle Europe before steppe conditions had passed away and a forest flora and fauna had become dominant.

FROM ASTROLABE TO QUADRANT.

We know that the great nautical discoverers were often out in their reckoning, and that therefore it is not always easy to identify certain places which they sighted or where they landed. And that this is so is not to be wondered at, when we consider the instruments at their disposal for the determination of positions.

One of the oldest instruments employed in taking astronomical observations at sea was the Astrolabe. This was not the armillary sphere described by Ptolemy, but a much simpler instrument consisting of a flat ring which could be suspended freely by means of a handle attached to its edge. Its upper quadrants were graduated from 0 up to 90° at the point of suspension. An alidade, pivoted at the centre of the ring, was furnished with two holes or slits (at A and B in fig. 1) lying in a line with the centre. When the altitude of the sun was taken, the astrolabe was held up and turned round until the rays of the sun fell

parallel to its plane; then the alidade was moved round until the light passed through the two slits. Its extremity then indicated on the scale the altitude of the sun. But on a rolling vessel even a practised hand could not obtain very accurate results.

A modification of the astrolabe was made as follows:—In the flat edge of one of the upper quadrants of the ring an aperture was made, gradually narrowing down to a small hole at the inner circumference, so that the section of the aperture in the plane of the ring was a right-angled triangle, with its vertex forty-five degrees from the point of suspension. If the sun were on the horizon, a ray would pass through the aperture horizontally to the opposite point on the ring, which was marked 0°, while if the sun were vertical the ray would pass downwards to the lower part of the ring, and this point was marked 90°. Thus the semicircle opposite the aperture was divided into ninety degrees of altitude, and the interval of one degree was twice as large on the scale of this instrument as on an astrolabe of the same size.

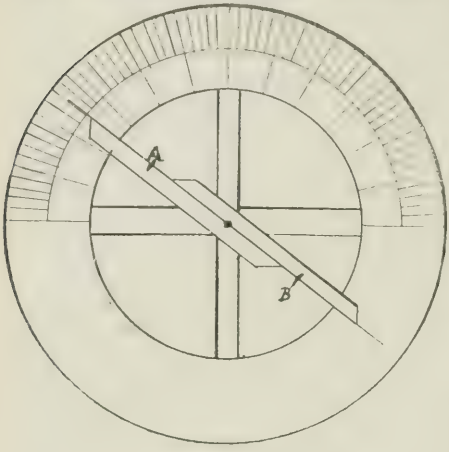


Fig. 1.

When the sky was cloudy, and the sun's rays were not sufficiently bright to be clearly visible on the astrolabe, what was then known as a Quadrant was used. This was a wooden instrument in the form of a quadrant of a circle. It was held with the angle upwards and the circular edge downwards, and turned so that the observer could see the sun through two sights on one of the radii. A plumb-line attached to the angle then indicated the altitude on a scale marked on the arc. There is a clinometer on the same principle used for measuring the dip of strata.

The astrolabe and quadrant were the instruments carried by Columbus, Magellan, Vasco da Gama, and the other great discoverers of the end of the fifteenth and beginning of the sixteenth century. The earlier astrolabes were huge instruments of wood, very difficult to handle, and therefore seamen were glad to find some place where they could land and take their observations undisturbed by the motion of the ship. When Behaim was in Portugal, he drew up improved tables of solar declination, and the *junta* on which he sat introduced smaller astrolabes of brass. Whether the modified astrolabe above-mentioned, the *Seering*, was known before the discovery of America cannot be decided. Another instrument is mentioned by Sacrobosco as in use among Portuguese mariners; this is Behaim's Cylinder, a portable sun-dial, which served to find the local

time, and by properly adjusting the gnomon, would also give the sun's altitude.[1]

Gradually these instruments were replaced by the Jacob's or Cross Staff, which, under various forms, remained in use until the invention of the quadrant by Hadley in 1731, and was not entirely discarded until several years later. The story of its invention and development is told in detail by Herr A. Schück in the *Jahresbericht der Geogr. Gesell. in München für* 1894 *und* 1895. He first describes the instrument from specimens in the Royal Navigation School in Altona and in the Hamburg Museum of Art and Industry. A staff of rectangular cross section, thirty to thirty-four inches long, is the central part of the instrument (AF in fig. 2). On this slide cross-pieces (BC) at right angles to the staff. On every side of the staff the angles are marked for intervals of ten minutes. With this implement the angular distance between any two points—the altitude of a star, the distance between two stars, the length of a comet, etc.—can be measured. The end of the staff, thinned off to a point, is held to the eye, and then the cross-piece is moved backwards and forwards until its extremities coincide with the points to be observed. The directions from the eye to the extremities of the cross-piece enclose an angle which is marked on the staff where the cross-piece is placed. In fig. 2 ABS is the direction of the sun, and AC of the horizon, the eye being placed at A. Then BAC is evidently the altitude of the sun. As the cross-piece is moved towards the eye-end, the angle it subtends increases, till it ultimately becomes 180°; but the graduation of the Jacob's staff is never carried beyond 90°, for it is impossible to observe at once two points at a greater angular distance, and the intervals of the scale become too minute.

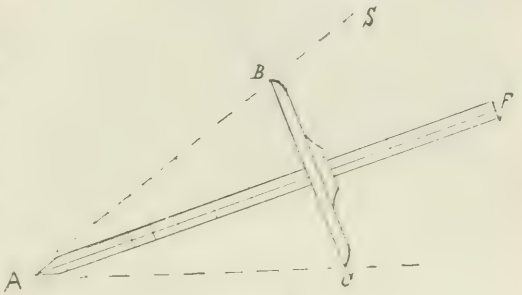


Fig. 2.

Indeed, with the smallest of the cross-pieces (No. 4) to one of the instruments mentioned, measuring some three or three and a half inches, graduation in ten minutes' intervals becomes impracticable after 20°, and therefore only every half degree is marked up to 30°; between 30° and 90° there is only the mark for 60°. The cross-piece No. 3, six and a half to seven inches in length, measures every ten minutes up to 40°, and every half degree between 40° and 60°. For No. 2 the graduation at every ten minutes is continuous from 28° to 60°, beyond which it shows only half degrees up to 90°. Lastly, a fourth cross-piece, twenty to twenty-five or twenty-six inches long, can be used for measuring any

[1] "Die Instrumente der nautischen Astronomie," von E. Gelcich, in *Hamburgisch Festschrift zur Erinnerung an die Entdeckung Amerikas*, Bd. i. Hamburg, 1892.

multiple of ten minutes up to 85° or 90°. The scales for the different cross-pieces are marked each on a different side of the staff. The cross-pieces are about one and two-third inches broad and one-third inch thick, and are strengthened in the middle that they may retain their perpendicularity to the staff. They can be clamped to the staff by screws. Even with the smallest cross-piece there is a minimum limit to the angles that can be measured. Owing to the end being pointed this limit is about 7°, but the usefulness of the instrument at sea was not sensibly lessened thereby, as stars of greater altitude could be selected, or the sun's altitude taken when it was greater than this limit. Sometimes also the half only of the cross-piece was used, the scale being calculated for the right-angled triangle contained by the staff, the half cross-piece and the line of sight, instead of for the isosceles triangle referred to above.

Naturally, in taking the altitude of the sun the eye was dazzled by the rays. This might be obviated, partially at any rate, by making the cross-piece broad enough to cover the sun, and taking the altitude of its upper limb; then a deduction was made for its semi-diameter. But a better method was for the observer to turn his back to the sun, clamp the cross-piece to the eye-end, and, looking under the edge of its extremity towards the horizon, move the instrument till the shadow of the other end of the cross-piece fell on the staff in the plane of the horizon. Thus the same isosceles triangle was obtained as before, but with the eye at another angle. This position is shown in fig. 3. The eye is placed at C looking towards the horizon along CD. Then the triangle CDB is the same as the triangle BAC in fig. 2, and the distance marked on the scale is the same as when the eye is at A and the cross-piece at D.

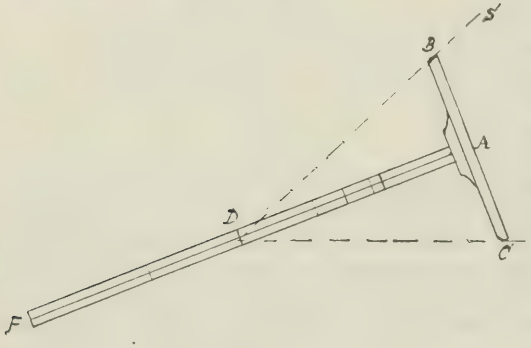


Fig. 3.

Professor Günther of Munich has proved that a Jew, Levi ben Gerson, was the inventor of this instrument, or, at any rate, the first to describe it. He was born in 1288, or the end of 1287, at Bagnolos in Catalonia, and lived in Avignon and Orange; he died in 1344. Among his works is one on astronomy written in 1328, and here and there improved by fresh observations down to 1340. In this he describes a newly invented instrument which he styles the Discoverer of Hidden Things, and celebrates in two small poems, one of them with the superscription "To the Staff." More than a century elapsed apparently before astronomers made use of Levi's invention. In 1472 Regiomontanus described a similar instrument, which no doubt was the Jacob's staff of Levi ben Gerson, and gave directions for measuring

the length of a comet with it. As he directs that the staff is to be five to six or more ells in length (an ell is rather more than two feet), it is easy to understand why it was not used at this time by sailors. An assistant must move the cross-pieces, and a crutch would be necessary to support the staff, so that an observation could not be taken with the rapidity necessary on a rolling vessel. The scale, moreover, consisted of equal intervals, instead of representing degrees and minutes of angular measurement, so that a calculation was necessary after the observation had been taken.

A very simple form of the instrument consisted of a rod with holes into which a small stick could be inserted. To obtain the height of a distant object the stick was placed in one of the holes and the observer walked backwards or forwards till he found the spot where the extremity of the stick covered the summit of the object to an eye placed at the end of the rod. Then the stick was moved forward to another hole and the observer went back till he found the spot where the summit was again covered. Then, knowing the distance between the two stations, he could calculate the height of the object. It has been suggested by Steinschneider that such rods would have some resemblance to the spotted rods by means of which Jacob increased his flocks, and that hence the instrument took its name.

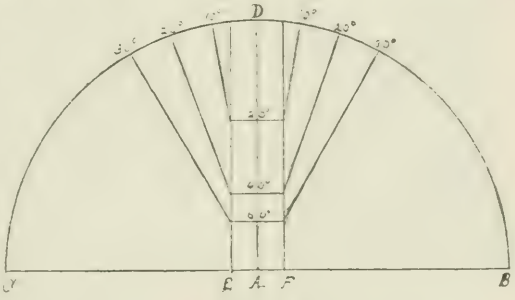


FIG. 4.

Jacob Werner of Nuremberg published a book in 1514, in which he showed how to graduate the staff in degrees and minutes. He drew a semicircle (BCD in fig. 4), of radius equal to that of the staff, which he divided into degrees of arc. The central radius (AD) represented the staff, and two parallels (through E and F) were drawn on either side at distances equal to half the length of the cross-piece. To find the position of the cross-piece for, say, 20°, radii were drawn from the centre to the arc at 10° on either side of the central radius representing the staff. The points where these intersected the parallel lines already mentioned were joined by a straight line, which represented the position of the cross-piece for 20°, and the point where this line crossed the central radius was accordingly marked 20°. The minutes were obtained, not quite accurately, by dividing the interval for each degree into sixty equal parts. Werner also gave instructions for calculating the lengths by the tangent tables of Regiomontanus.

It would take too much space to tell what other mathematicians, among them Apian and Gemma Frisius, did for the instrument. We must pass on to the consideration of the Jacob's staff as a nautical instrument. There is reason to believe that it was Çacutos or Zakelt, a Jew of French origin, who introduced it into Portuguese vessels. At any rate, Pedro de Medina mentions it in his *Arte de Navegar* (1540)

and his *Regimiento de Navegacion* (1563) as an instrument for measuring altitudes at sea, and Martin Cortez describes it at greater length. Soon English and Dutch seafarers began to compile books on navigation, and one of the earliest, Bourne (1573), mentions the "Balla Stella" (Spanish *ballestilla*.) He speaks of the difficulty of observing the sun, being evidently unacquainted with the method of taking the altitude by the shadow, though it was known before his time, being described by Gemma Frisius. Another English writer, Thomas Hood (1590), distinguishes between the Jacob's Staff, or Balla Stella, and the Cross Staff, applying the former name to the instrument for terrestrial measurements, graduated in equal divisions.

Several additions were made from time to time to the staff, such as coloured glasses, at the extremities of the cross-piece or at the eye-end, eye-pieces with slits to fix the line of sight, and slides on the cross-piece to obviate the necessity of using more than one. We need allude here only to two more inventors, John Davis and Joost van Breen. Davis first made a staff on which the angles up to 30° were read on the cross-piece with the aid of sliding sights, and from 30° to 90° on the staff. The length of the staff was a yard. But his most perfect instrument had two cross-pieces, the upper one meeting the extremity of the staff at an angle of 60°, the lower inclined to the staff at the same point at an angle of 30°. The extremities of these cross-pieces were connected with rods to the staff so that the instrument consisted of two triangles, one on each side of the staff. The rod subtending the angle of 60° carried a sliding sight (R in fig. 5), which could be moved so that its shadow was thrown on to a slit (at P), at the end of the staff, through which the horizon could be seen from a sliding eye-piece (at Q) on the base rod of the lower triangle. Both the base rods were graduated, and the altitude was the sum of the angles on either side the staff. Thus in fig. 5 the altitude is the angle RPQ. Afterwards the cross-pieces were made circular arcs, and Flamsteed inserted a lens in the eye-piece. This instrument was known as the English or Davis quadrant, and was much used until the universal adoption of Hadley's reflecting "octant."

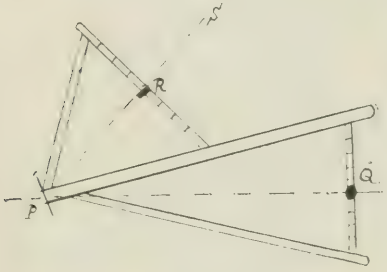


FIG. 5.

The instrument made by Joost van Breen in 1662 is chiefly remarkable as being the first in which a mirror was used. It had only one cross-piece with sliding sights, and at the other end of the staff was fixed a small mirror with a slit through which the horizon could be seen from an eye-piece on one of the slides. The shadow of the upper edge of the other slide was made to fall on the slit, and the upper half of the sun or other heavenly body was reflected from the mirror above towards the eye. It is perhaps singular that almost seventy years more elapsed before double reflection was made use of.

The defective graduation, the eye parallax, and other circumstances rendered the Cross Staff no very accurate instrument. Herr Schück finds that the error on *terra firma* in general amounts to 10′ or more, and only under very favourable circumstances is as small as 5′. At first the staff appears to have been used only for the measurement of altitudes of the Polar star, observations of the sun being liable to large errors until the method of observing the shadow became generally known.

Thus the latitude of the ship was ascertained more or less closely. Not till the end of the sixteenth century was the probable error reduced to 1°. As for longitude, there seems to have been no reliable method available at sea before the introduction of chronometers. The method of lunar distances with the instruments then in use, and the imperfect knowledge of the moon's motions, was very defective. Sebastian Cabot's method of measuring differences of longitude by the change in the sun's declination, the rate of which he assumed to be constant, was also liable to large errors. On his return from his first voyage to America, Columbus made an attempt to find his position by the variation of the magnetic declination. Pigafetta directs that the meridian should be found by an observation of the sun at noon, and states that the deviation is equal to the difference of longitude between the place of observation and the meridian of no deviation. Mercator found the magnetic Pole by the intersection of the directions of the needle at two different places, fixing it at 79° N. lat. and 12° W. long.—a very bad guess indeed, but probably easily accounted for by the lines of equal deviation over Europe and the Atlantic at that time. To this point, he assumes, the compass needle must point, and hence easily obtains the longitude. The only really trustworthy method was by eclipses of the moon, and these did not occur often, so that the longitudes of only a few places were known. Nor was this method available at sea. Robert Hues speaks of attempts to find the longitude by the time, for which purpose clocks, hour-glasses, with sand or water, and other time-measurers were suggested, and he condemns those who made a gain by selling such contrivances. To those who bought them he says: "I admonish these men, by the way, that they beware of these fellowes, least when their noses are wiped (as we say) of their money, they too late repent them of their ill-bought bargaines."[1]

THE EVOLUTION OF COMMERCE.[2]

M. Letourneau has written a work which is undoubtedly of great value to students of commerce. It gives an account, based upon competent authorities, of the economic conditions of people of all parts of the globe at different times, beginning with the most primitive types, those in

[1] *Tractatus de Globis et eorum usu.* Edited by Clements R. Markham, C.B., F.R.S., 1889 (Hakluyt Soc.).

[2] *L'Évolution du Commerce dans les diverses races humaines.* Par Ch. Letourneau. Paris: Vigot Frères, 1897. Pp. xxiii+581.

which commerce does not exist at all, and proceeding (we will not, lest we should misrepresent the author's position, say advancing or rising) to those in which commercial relations are most completely developed. In the opening chapter he even considers the analogues of commerce to be met with among the lower animals, and on pp. 4-5 he gives one instance of great interest to naturalists and more particularly to ornithologists of what might almost be called systematic barter, and even barter on credit, between an eagle-owl and a hunter. To students the value of the work is greatly enhanced by the fact that the author nearly always gives precise references to his authorities whether first or second hand.

In the sections dealing with peoples who have reached a more complex stage of commercial development, Mr. Letourneau gives first an account of the state of industry among them, then of commerce and the means and instruments of commerce (communications, money, credit, and interest), and winds up with a paragraph or two on commercial evolution. In these last paragraphs one often meets with considerations of extreme interest and suggestiveness, such, for example, as the following on the barbarous period in the Middle Ages:—

"First we observe that, in spite of the fact of their being whites, they (the barbarians of Europe) started in civilisation at as low a level as the coloured races. Thus, as regards industry and commerce, those natives of Europe are very comparable to the black populations of Central Africa; they were even markedly inferior to them in these respects before they were more or less drawn onwards and civilised by contact, by relations pacific or otherwise, with strangers, Phœnicians, Latins, etc., from the countries of the Mediterranean. These latter initiated them into the practice of exchanges, familiarised them with money, but at the same time inoculated them with the taste for gain, the custom of lending at interest, etc., in short, prepared them for being conquered and assimilated by Rome."

But in spite of the suggestiveness of such paragraphs, it can hardly be said that the volume answers to its title. What we miss in it is precisely an account of the evolution of the commerce of the world as a whole, an evolution that nevertheless has taken place in human history. We are not enabled to follow the steps in a regular sequence of change such as is suggested in the very title of the work which has unquestionably given the greatest stimulus to the study of evolution in a great variety of subjects, *The Origin of Species by Means of Natural Selection.* The idea in that work, which, whether sound or unsound, has proved so fruitful of results, is that changes in organisation have been perpetuated by changes in the surrounding conditions, and in the history of commerce no idea is worthy of more careful and consecutive study, for the very changes that have inevitably influenced commerce, have themselves been to a large extent the results of commerce and its necessary accompaniments. In the pages of Mr. Letourneau we get frequent pictures of the changes that are gradually wrought in a commercial people, but no steady recognition of the fact that their life is lived in a changing world—a world in which forests are steadily getting cleared, marshes drained, larger areas cultivated, wider and wider regions brought under the

influence of complex economic conditions, areas, on the other hand, once cultivated, relapsing into waste, and so forth.

If this point of view had been steadily maintained we should have had more continuity in this story of evolution, and as one instance of the result of failing to maintain it, we may note the author's misrepresentation of the facts as to the great oceanic discoveries at the close of the fifteenth century. The conquest of the Turks, he says, forced the Christians to seek for new markets (p. 513). The thing appeared impossible, but the seeming impossibility was achieved by the great discovery of Columbus, and that discovery "inspired numerous explorers to launch out in imitation of him on seas hitherto unknown. The names of Jacques Cartier, of Vasco da Gama, of Albuquerque, of Magellan and many others, are known to all the world" (p. 515). Now, in this way of putting the facts, there is, as Mr. Letourneau must be well aware, a double misstatement. It is surely utterly wrong to say that the voyage of Vasco da Gama was inspired by that of Columbus. It was the direct though remote result of the efforts of Prince Henry the Navigator, begun fourscore years before, to reach the Indies, the source of the much-prized pepper and spices of those days, by way of South Africa, and it was in order to reach the same goal, not to discover new markets, that Columbus set out on the voyage by which he made a discovery, the precise nature of which he did not live to learn. As he himself said, at the age of twenty-eight he began to serve "for the discovery of the Indies," and so much was this idea of reaching the Indies, "the east," in the minds of Atlantic navigators of those days, that they spoke of sailing "to the east" when their course was in fact westwards.

This misstatement of Mr. Letourneau's is worthy of note because it is significant. It is, of course, not due to ignorance or to any desire to mislead. It is solely due to the circumstance that the author's mode of conceiving his subject made him indifferent about setting the facts in their true light, and yet it is obvious that in a strictly consecutive account of the evolution of commerce, it is essential that they should be set in their true light.

Further, if the point of view above indicated had been consistently maintained we should have had less space devoted to a mere denunciation or exposure of the evils of commerce. It is no doubt true that the benefits of commerce are too often extolled and even exaggerated, while the eyes are kept closed to the attendant evils; but we doubt whether any one will be convinced by the author's continual suggestion that the increase in the scale of commerce, and the rapid spread of the commercial spirit, has meant little else in the history of humanity than an increase in the magnitude of those evils. We say the continual suggestion, for we must admit that this is no formal doctrine of the author's, who from time to time makes a brief and formal acknowledgment of the benefits, or some of the benefits, of commerce. The suggestion, however, recurs constantly, which is all the more strange in consideration of the vision of the future with which the book concludes—a vision of a confederacy of republican cities in which "there is as much of a communal organisation as consists with a due respect for individual liberty; in which a

relentless competition, the struggle of each against all and all against each, will no longer be the so-called social law; in which large fortunes will be unknown, almost impossible, and at any rate little to be desired; in which the desire of money will no longer befool and sterilise the mind: in which industrial production will be proportioned to real needs, will have become sane and intelligent, and hence deserving of honour," and so forth. True, the author tells us this golden age will not come in our day, but he adds that it must come. If so, one may ask, are we at some future time, however remote, to step at one bound into this ideal state? Is the change to be as if the blind were suddenly to receive their sight? Can no steps be detected which are even now taking us, however slowly, in that direction? So far as one can learn from Mr. Letourneau there are none. He tells us that in the future the civilised races will recognise their duty to educate the uncivilised, not to exterminate them, and will even perceive that, everything taken into consideration, they will find their advantage therein, but he can see no trace of such discoveries having been made under the influence of commerce in the past. He does not refer, like a distinguished economist of our own country, to the abolition of slavery (in the present century) as "the greatest industrial invention the world ever saw."[1] In fact he does not mention it at all, but the creation of a practically enslaved "wage-earning class," or "proletariat," under the modern factory system weighs upon his mind. He pays no heed to the saying "that he is the best business man who contrives to pay the highest wages," which another English economist cites as not uncommon,[2] or, as an American economist and statistician puts it, that "high-priced labour is cheap, because more effective in making goods at low cost."[3] Of course it was not incumbent on Mr. Letourneau to accept such statements. He might reject them all as mere sophistry; but the point of view suggested by them was at least entitled to consideration in a serious work on the Evolution of Commerce. As it is, Mr. Letourneau is, we fear, biassed by his preconception, or at least ingrained conception, as to the general tendencies of commerce, even with regard to evidence on matters of fact; and from the general character of his references to the treatment of the black races by the whites, we suspect that little heed would be paid by him to the evidence, for example, of Mr. Bryce as to the behaviour of the whites in South Africa, or to such a note as Captain Bertrand has published in his diary as to the striking contrast presented by the Zambezians, returning to their homes after working for some years in the mines opened by the whites, to those whom he met "lean, distrustful, and possessing nothing but their calabashes hanging at the end of long sticks," going to seek work there. The truth is, that there are engaged in directing industrial operations, or even exploiting new countries, just as in the chairs of professors and among students, people with larger and narrower sympathies, and with higher and lower sense of duty. We

[1] J. S. Nicholson, Inaugural Address to the Scottish Society of Economists.—*Econ. Jour.*, vol. vii. (1897), p. 549.

[2] Marshall, *Principles of Economics*, vol. i., 1st edition, p. 575.

[3] Edward Atkinson in *Popular Science Monthly*, Jan. 1890, p. 298.

rate the width of sympathy and the conscientiousness of Mr. Letourneau highly, but we would seriously urge that some tolerance of inevitable human weakness is favourable to insight in inquiries relating to human conduct. It has been characteristic of the highest moralists in all ages.

GEO. G. CHISHOLM.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

MEETING OF COUNCIL.

AT a meeting of Council on June 3rd, it was resolved to submit a note on the adoption of "Standard Time," drawn up by Prof. Copeland and Dr. Burgess (see p. 323), to the Secretary of State for the Colonies, the Secretary of State for India, and the Chief Secretary to the Lord-Lieutenant of Ireland.

Ordinary Diplomas of Fellowship were conferred on the Rev. Hugh Callan, M.A., and Mr. Wm. Jeffrey.

CLOSING OF THE ROOMS.

The Society's Rooms will be closed during August for cleaning, etc.

GEOGRAPHICAL NOTES.

By THE ACTING EDITOR.

EUROPE.

The Vasco da Gama Celebrations.—The Delegate of the Society has forwarded the following report :—

"Nominated to represent the Royal Scottish Geographical Society at the Celebration in Lisbon of the Fourth Centenary of the discovery by Vasco da Gama of a maritime route to India, I arrived in the Tagus on the morning of Monday, 16th May. Already the city was gay with flags, and thronged with visitors from all parts of the country and from foreign lands, while in the roadstead an imposing line of ships of war represented the navies of the other European powers. The same evening I attended a solemn session of the Society of Geography of Lisbon, held in their magnificent hall, the Sala de Portugal, and presented my credentials. The hall was crowded to overflowing with a brilliant audience. His Majesty the King, D. Carlos, presided, and was accompanied by the Queen and the royal family, attended by the ladies and gentlemen of the court. There were present also all the foreign diplomatic representatives (except the minister of Spain), the members of the Portuguese ministry, the officers of the foreign ships of war at the time in the Tagus, many Portuguese officers, both of the army and navy, the high clergy, and all the best Portuguese society.

"The King, having declared the session opened, called upon Conselheiro Ferreira do Amaral, president of the Central Commission of the Society of Geography of Lisbon, who delivered a learned and patriotic address. Occupying the tribune,

His Excellency congratulated the King and the Portuguese people on the glorious event which they were about to celebrate, and on the honourable and patriotic evidence given at this time of the respect and veneration in which they held the memory of one of the most glorious of their historical traditions; and in the name of the Society of Geography he thanked all those who were assisting in the solemnities. He referred to the time of the conquests, by means of which the Holy Faith was carried to distant lands, and to the feats of the Portuguese arms in the great continents. And he claimed for the achievement of Vasco da Gama a world-wide homage, now being fitly paid by the combined voice, not only of the Portuguese nation, but of the whole world, and witnessed to by this gathering of the representatives of all nations and of all the foreign navies. He spoke of the difficulties with which Vasco da Gama, and the other great Portuguese navigators, had had to contend, citing many facts in corroboration of the boldness and daring, never denied, of these discoverers, and emphasising the importance of the services rendered by them to the cause of civilisation.

"He was followed by Mr. Groot, representative of the Dutch committee, who, in finishing his speech, delivered to His Majesty a silver crown and an album subscribed by his Society in commemoration of the event. Others followed, but as time would not permit of all the delegates being heard in turn (the evening being already well advanced), a few only were called upon to speak. As can be imagined, these all expressed the warmest sympathy for Portugal, and conveyed in suitable terms the congratulations of their different Societies to the King and to the Geographical Society of Lisbon on the occurrence of so notable a centenary. Among them Lord Dunraven spoke on behalf of the Royal Geographical Society of London, and the Austrian Minister (Count de Brandis) for the Royal and Imperial Geographical Society of Vienna. But chiefly notable were the addresses of Conselheiro Herbette, vice-president of the French committee, and of Dr. João Monteiro, representing the Society of Geography and the Historical Institute of Rio de Janeiro. The latter, as coming from that greatest and most important of the Portuguese possessions in the New World, and which is still bound by ties of sympathy and of blood to the mother country, spoke at considerable length and with much fervour.

"H.M. the King, before closing the meeting, in a few words expressed the great pleasure he had in thanking, in the name of his country, all those countries who were represented in the commemoration of the centenary of India. He accentuated the significance and the great value of the event they were now celebrating, which was a culminating point in the history of Portugal and of the human race. Remembering that it was for their country's sake, and working for no selfish end, that these great Portuguese navigators had accomplished such prodigious feats, so now (he said), centuries afterwards, it is still for the fatherland that the Portuguese soldiers and sailors go to pour out their blood in Africa. And, taking for theme that all ought to dedicate their efforts and sacrifice themselves for their native land, the King finished with a graceful and touching appeal to Portuguese patriotism, calling to mind the necessity at this actual moment, when so many crises are impending, for united action and the suppression of all barren discussions and paltry disputes, and that all should labour solely and exclusively for their native land. And he closed by asking all to join him in a ringing cheer for that *Patria* which they held so dear.

"During the sitting many telegrams were laid on the table from similar meetings abroad, congratulating the Society and the nation on the auspicious occasion. Among them were messages from the Imperial Russian Society, St. Petersburg; the Royal Geographical Society of the Netherlands, Amsterdam; and from the

London Chamber of Commerce. The utmost enthusiasm was manifested throughout.

"The following are the foreign delegates who were present, viz.:—

The Minister of Austria, representing the Royal and Imperial Geog. Soc. of Vienna.
The Minister of Italy.
Lord Dunraven, Royal Geographical Society of London.
Mr. Groot and Mr. H. Watel, Holland.
Conselheiro Herbette, Paris.
The Marquis Masalière and Mr. Vedel, Paris.
Dr. J. Monteiro, Soc. of Geog. and Historical Inst. of Rio de Janeiro.
Dr. Béla Erodi, Soc. of Geog. of Hungary, Budapest.
Major James Lang, Royal Scottish Geographical Society.
Mr. Jules Leclercq, Congo Free State.
Mr. J. R. Newby, Manchester Geographical Society.
Mr. Raoul Bayert, Society of Geography of Alger.
Baron Danvers, Royal Asiatic Society.
Christian Weise, Consul-General of Denmark.
Luiz Breton y Vedra, Consul-General of Mexico.
Hans Bergstrom, Consul for Sweden and Norway.
Henri Bauer, Director of the Franco-Portuguese Bank.
Paul Chapuy, Director of the Royal Railway Company.

"Throughout the rest of the week the city was *en fête* and was illuminated for three nights. Thursday, 19th, was a general holiday, even the postal and government offices being for the most part closed, and there were celebrations daily. Chief among these was a solemn "Te Deum" at the church of Santa Maria de Belem (Jeronymos), where are the tombs of the two greatest Portuguese heroes, Vasco da Gama and Luiz de Camões. Here a high mass was celebrated by the Patriarch of Lisbon, and attended by the King and Queen and all the court in full state. It was a most impressive spectacle. The oration was delivered by the Archbishop of Evora, D. Augusto Eduardo Nunes. It was an eloquent tribute to the memory of the illustrious navigator, reviewing the difficulties he overcame and the perils he encountered, and inculcating the lessons of patriotism, courage, and tenacity, by which alone the glorious past could again revive and lead forward to a still more glorious future.

"The British Royal Navy was represented throughout the celebrations by six battleships detached from the Channel Squadron, under Vice-Admiral Fellowes, viz.:—*Magnificent* (flagship), Captain Gerald C. Langley, *Jupiter*, *Prince George*, *Repulse*, *Mars*, *Resolution*. The other foreign navies were represented as follows:—*Kaiser Franz Joseph* (Austria); *Oldenburg* (Germany); *Evertsen* (Holland); *Pothuau* (France); *Svetland* (Russia); *Daymar* corvette (Denmark); *Saga* corvette (Sweden). JAMES LANG."

The Temperature of the Surface Waters of the North Atlantic and the Winter Climate of Northern Europe.—Professor Pettersson showed in the *Meteorologische Zeitschrift*, No. 8, 1896, that the temperature of the North Atlantic is liable to small variations of temperature from year to year. The greatest differences on the Norwegian coast in the month of January, from 1874 to 1892, were only $+2{\cdot}9^{\circ}$ F. to $-2{\cdot}0^{\circ}$ F. from the mean value, but a comparatively small excess of temperature in the ocean in January and February is accompanied by a rise in the mean temperature of Örebro, Upsala, and other places in Sweden, amounting to as much as 9° to 11° F., while, on the other hand, a deficiency in the ocean temperature

is followed by a corresponding fall in Sweden. This question Professor Pettersson discusses more fully in the *Geographical Journal* for June, availing himself of Mr. Dickson's soundings in 1893 and 1894 in the Faroe-Shetland channel and the adjacent parts of the North Sea. The uppermost layer down to 100 or 150 fathoms is so homogeneous as regards salinity that vertical thermic circulation, caused by the contact of the Gulf Stream water with the colder atmosphere, acts throughout the entire bulk of the warm water layer. In August the superficial stratum, 25 fathoms thick, is heated to about 54° F., and from this time till November the heat stored in this layer is given off to the atmosphere. From November to February the vertical convection extends from the surface through the whole depth of the Gulf Stream water, which is thereby reduced from 48·4° to 43·5° F. by the heat delivered to the air.

The superficial stratum in the Baltic, 10 fathoms thick, is heated up to 59° F., and is the cause of the long mild autumn peculiar to the Baltic islands. From November the convection extends to the upper limit of the salt bottom water at a depth of 30 fathoms, and so much heat is parted with to the air that the temperature has sunk in March to 34·5° F., which is still high enough to prevent the freezing of the sea. It is long before the water regains the heat lost in winter, and hence the summer is retarded in the adjacent lands.

The heat absorbed by the atmosphere in the Norwegian and North seas loads the air with moisture, and produces the great areas of low pressure which exist in winter over the northern parts of the Atlantic. This view seems to be opposed to the theory that cyclones originate in the upper strata of the air. But the theory is based on a study of continental cyclones, which are detached from their place of origin, the ocean, and must soon perish unless they receive a new impetus.

In 1896 and 1897 Professor Pettersson and Dr. Ekman studied, as far as the observations allowed, the changes in the surface water south and west of Spitzbergen. In winter the flow of the Gulf Stream through the Norwegian sea relaxes, and Arctic water flowing down from higher latitudes partially overflows the area of warm water in contact with the atmosphere, and this influx seems to drive the cod and herring towards the Lofoten banks and fiords. Similarly, the herring leaves the Swedish banks when the cold Baltic current is in full flow along the coast. The Gulf Stream keeps up an almost constant surface temperature of 41° to 43° F., even at the highest latitudes, while the Arctic water rapidly falls in winter to 36°—32° F.

During the summer of 1896, and still more in 1897, the flow of the Gulf Stream towards the shores of Spitzbergen and into the Barents sea was remarkably strong, fortunately for the success of the Jackson expedition, and those of Colonel Feilden and Mr. Pike, and this strong flow continued almost unabated till last November, at which time the warm water seems so have extended over the Atlantic and Norwegian sea from lat. 59° to 75°. This vast expanse of warm water, with an area of 80,000 to 160,000 square geographical miles, evidently gave birth to the great barometrical depression of the succeeding month.

In January 1898 the change in the direction of the isobars, which then trended east and west, showed that the centre of depression lay north-west and north of Norway. There may be two reasons for the change. The Gulf Stream is continually moving northwards, and secondly, the Arctic current from between Jan Mayen and Iceland probably impinged on the Gulf Stream and covered its southern part.

The Rainfall of Seathwaite.—This is well known as the wettest spot in the British Isles. The records of rainfall now extend over fifty-three years, and the later

records of the Royal Meteorological Society's gauge, 1881-97, are discussed by Mr. William Marriott in the *Quarterly Journal* of the Royal Meteorological Society, January. The hamlet of Seathwaite, consisting of about five houses, stands in a valley at the southern end of Borrowdale at the foot of Glaramara, 2560 feet high, and the Wad Hole Moor, nearly 2000 feet. The rain-gauge is 422 feet above sea-level. The mean annual rainfall obtained by Mr. Symons for the fifty years, 1845-94, is 137·31 inches, but that for the seventeen years of Mr. Marriott's period is only 130·06. The wettest month was August 1891, with 26·69 inches of rain, and the driest, September 1894, with 0·59 inch. On the average, April is the driest month, followed by June and May; in no April during the period did the fall reach 10 inches. The greatest fall in one day was 8·03 inches on November 12th, 1897, and since 1845 falls of 6 inches and over have occurred, as far as is known, on eleven days. With a view to ascertaining the atmospheric conditions under which heavy rainfalls occur at Seathwaite, Mr. Marriott compared the falls of 2 inches and over with the direction and force of the wind at Barrow-in-Furness, and as the observations here were made only twice a day, and were not published after 1889, he also used the records of the anemometer at Fleetwood. These showed that when the fall at Seathwaite was 3 inches or more, the wind was south or south-west with a high velocity ranging from 496 to 1167 miles in the 24 hours; the stronger the wind, the heavier is the rainfall.

Three miles south of Seathwaite is Scafell Pike, the highest mountain in England, 3210 feet high, and to the east of this is Bow Fell rising to 2960 feet. On the west of Scafell lies the deep valley of Wasdale, with Kirk Fell, 2631 feet, and Great Gable, 2949 feet, to the north of it. Between Wasdale and Borrowdale is the Styhead Pass, about 1500 feet above sea-level. To the east of Bow Fell lies the valley of Langdale. It will be seen, then, that when the wind is between south-east and south-west it will be concentrated in these valleys and rush up them with considerable force. The air current will have swept over the Irish Sea and met no obstruction till it has reached these hilly districts, where it will be forced upward, and by the consequent reduction of temperature will part with its moisture, causing the heavy rainfall of Seathwaite.

The Distribution of Population in Sardinia.—The *Rivista Geografica Italiana*, Ann. v. Fasc. 2-3, contains an account of the distribution in the island, with respect to distance from the coast, by Signor Angelo Cossu, who at the meeting of the Italian Geographical Congress treated of the distribution as connected with the composition of the soil. Like Dr. Marinelli, in examining the population of Sicily (vol. xii. p. 471), Signor Cossu drew contours on a map of the island at intervals of five kilomètres. The off-lying islets measure 106 square miles, and the main island 9188. Towards the interior the area within each contour decreases down to 1033 beyond 40 kilomètres (about 25 miles) from the sea. The mean distance of all parts of the island from the sea is 7·42 miles. An examination of Signor Cossu's table shows that the islets are the most densely peopled, then the coastal zone of Sardinia itself. In the next zone the population quickly diminishes, till it falls below the average for the whole island (about 72·8 to the square mile), while in the following it almost approaches that of the maritime lands. Since 1845 the inhabitants of the islets have increased by more than 43½ per square mile, and those of the costal zone by 18, the augmentation falling in each successive zone towards the interior.

Signor Cossu gives also tables showing the density of population on each slope, from which it appears that on the southern slope the density is greatest on the coast, and diminishes towards the interior till it reaches the zone lying between

20 and 30 kilomètres from the sea, where it still is greater than the average for the whole slope; the increase shown by successive censuses is greatest on the shore, and almost insensible in the interior. On the eastern slope the density is very small (barely 39 in 1881), and the greatest density occurs in the innermost zone; here also the increase has been greatest near the sea. The greatest agglomeration of population on the western slope is in the zones between 5 and 10 kilomètres and between 30 and 40 kilomètres from the coast, and the greatest increase in the former zone. On the northern slope also, one of the most populous, the coastal zone has a density less than the average (70 per square mile, compared to 95·8), while the zones between 10 and 15 kilomètres and beyond 40 kilomètres are most thickly peopled, in the former of which the greatest augmentation has occurred.

The Crater of Mount Etna.—In 1894, Professors A. Ricco and T. Zona tried to determine the depth of the crater by the fall of stones. The mean result of their observations was 1391 feet, which, even after allowance was made for the resistance of the air, was much in excess of the estimated depth, and therefore the Istituto Geografico Militare sent the engineer R. Grechi last year to make a fresh survey of the summit. Making use of a tacheometer, and fixing four stations on the edge of the crater, and three at the base of the cone (near the Observatory), Signor Grechi constructed a map on the scale 1:10,000. From this map the vertical distance from the highest point at the south, 10,741 feet, to the bottom at 10,210 feet above sea-level, was found to be 531 feet. The great difference between the two results may be explained by the fact that in the interval between August 1894 and August 1897 the bottom has been to a great degree filled up by frequent falls of large fragments from the crater walls, which have at the same time lowered the height of the edge. Moreover, the throat of the crater was open until the end of August 1894, whereas in 1897 it was closed. The new survey exhibits the alterations in the elevation of the crater rim. In 1868 the highest point was at the north-east, and stood 10,869 feet above sea-level, whereas now the highest point is at the south and is only 10,741 feet high. The dimensions and form of the opening are also changed, the larger diameter having increased from about 1300 to 1640 feet, and the smaller from 1150 to 1300 feet.—*Boll. della Soc. Geogr. Italiana*, April.

ASIA.

The Railway from Beirut to Damascus and El Mezeirîb.—This railway, constructed by French capital, follows fairly closely the old caravan route. From the Beirut station, at the east side of the town, it mounts south-eastwards towards Aleih, and rapidly attains a considerable altitude. A toothed rail is laid along a large part of this section, the gradient being often as much as 7 in 100, and many of the curves have a radius of little more than 100 yards. The views from Beirut to the culminating point, 5059 feet above sea-level, are superb, embracing on one side the Sunnin, Jebel el Kuneiyiseh and Amana, and on the other Jebel Baruk and Hermon. At many stations on the line are health resorts, to which the inhabitants of Beirut flock in summer. At Ain-Sofa, about 4200 feet above sea-level, there is a fine European hotel. By a tunnel the railway leaves the Mediterranean slope and descends rapidly towards the plain of El Bukeiah, the ancient Cœle-Syria, emerging from the Lebanon a little beyond the station Mualakah. The plain is more than twelve miles broad. On the eastern side the railway traverses the gorges of the Wadi Yah-fufa, one of the affluents of the Litany, and then turns southward to Zebdany, celebrated for its fruit, whence it follows the Barada (Abana), a stream which flows through Damascus and loses itself twelve miles east of the town in the lake Ateibeh. On the way may be seen the ancient Abila, now named Suk Wadi

Barada, a ruined aqueduct, tombs, and other antiquities. The distance from Beirut to Damascus is ninety miles, and the journey lasts eight hours. There is at present no station at the latter town, its construction having been postponed until the route is fixed by which the railway is to be carried on towards the Euphrates. The inhabitants of the town demand that the line should be carried through Nebk, whereas the company prefers a route passing through Baalbek.

A branch from Damascus to El Mezeirib, sixty-three miles long, maintains communication with the region of the Hauran and the Lejah in the direction of the great caravan road to Mekka. It passes the important village of Kesweh, near the Nahr el Awaj, possibly the Pharpar of the Bible, and Sunamein, rich in ruined temples and other ancient buildings. Sheik Meskin, fifty miles from Damascus, will become an important station owing to the removal thither of the seat of government of the Hauran. At El Mezeirib pilgrims congregate on their way to Mekka, and bathe in the large pool of Bajjeh, which is held to be sacred. On an island in the midst of the water are the remains of the ancient town. Besides passengers, the Hauran railway transports the produce of the country, consisting chiefly of cereals.—*A Travers le Monde*, No. 6.

The Southern Chin Hills.—In a report on military operations to the north of Arakan, Captain Rigby gives also some geographical details. The backbone of the whole region is the Arakan Yoma range, 6000 to 7000 feet high, which separates the streams flowing westward to the Gulf of Akyab from those feeding the Irrawaddy. West of this range there is a series of densely wooded ranges running north and south, and drained by the Lemru and Kaladan rivers. To the south-east an important spur branches off, known as the Kunumchung range. It is higher than the main range, and culminates in Mount Victoria (10,090 feet), the highest peak in Burma. Between it and the Yoma range flows the Mon river, which, after a course of 160 miles, joins the Irrawaddy a little north of Minbu. Long spurs, running eastward from the Mount Victoria range, render travelling difficult from north to south. The climate in the higher parts of the country is cold and bracing; rain does not apparently fall heavily, as there are no signs of floods in the larger streams. Economically the country is of little value, and food supplies are limited; millet is the chief crop. The Yoma range is densely wooded, chiefly with oaks. Elephants and rhinoceros have vanished from the eastern side of the watershed, but black bear, bison, sambhur, barking deer, etc., occur in large numbers.—*Geogr. Journal*, May.

AFRICA.

The Climate of the Algerian Sahara.—Means have now been obtained of the temperature during the four years, 1892-1895, at El Golea, the most southern meteorological station in the Sahara. The annual mean, reduced to sea-level, is 75·7° F.; the January mean is 53·1°; and the July mean 98·4°, one of the highest in the world. The absolute extremes in the four years were 112·2° and 23°. The relative humidity falls in July and August to 16 per cent. The rain is insignificant in amount; most of it falls apparently in December and April, and in spring thunderstorms occur occasionally. Frosts are common in December and January. The prevailing winds are north-west and north in winter, and east and south-east in summer. Numerous ruins and wells, and date-palms extending for a distance of twelve miles, seem to indicate that the Golea oasis was at one time rich and well-peopled. In spite of the great heat and the burning sand storms, the country is comparatively healthy. Water is abundant. The dates are, indeed, of poor quality, but the artificially watered gardens produce lucerne, barley, wheat, and maize.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xxv. Nos. 2 and 3.

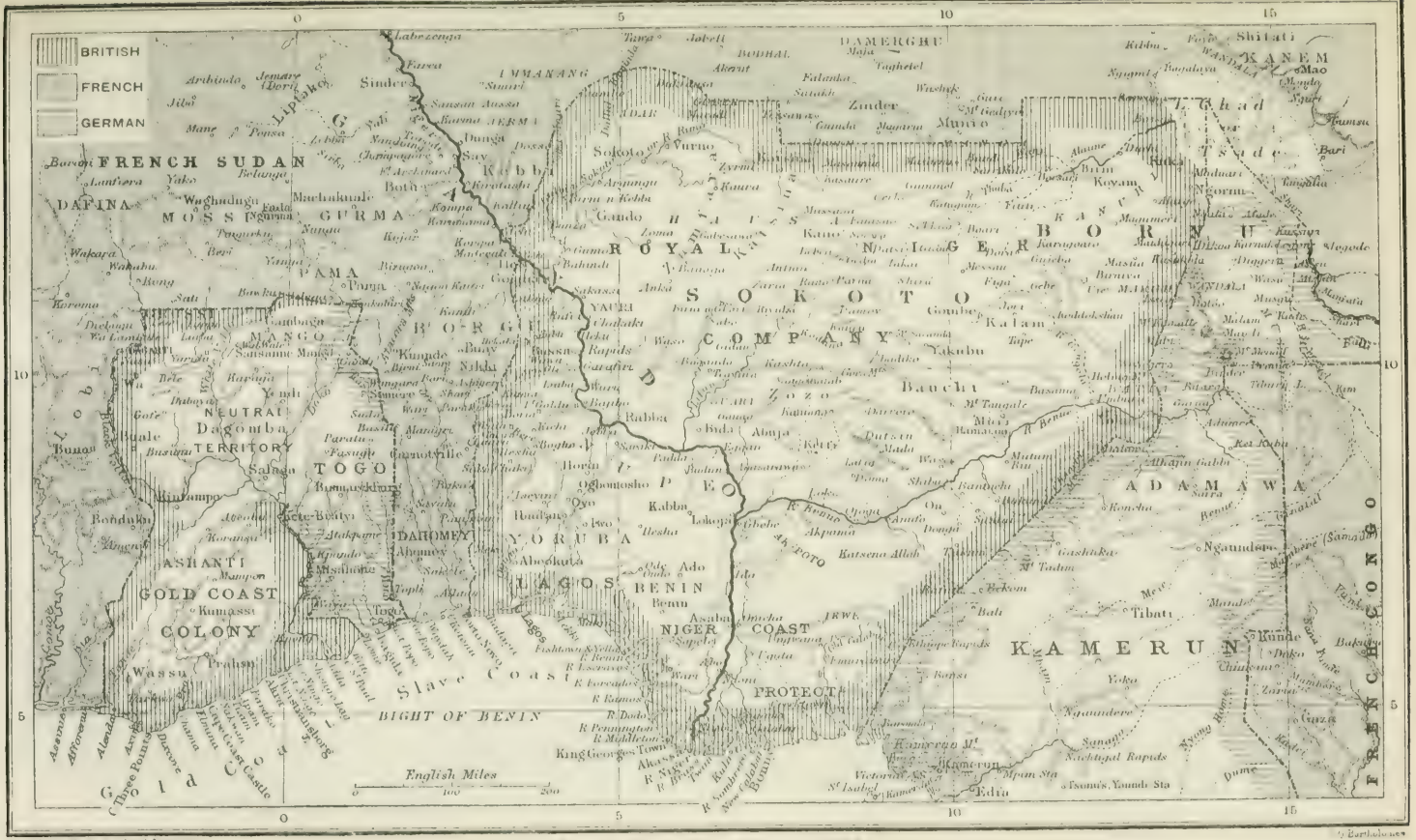
The Anglo-French Convention.—By the agreement of July 12th, 1893, the western boundary of the Gold Coast Colony was defined up to a point on the Black Volta in lat. 9° N. In the convention concluded on June 14th, the boundary is carried along the same river up to the 11th parallel. It then follows this parallel eastwards as far as the river passing immediately to the east of the villages Zwaga (Souaga) and Zebilla (Sebilla), and then ascends the western branch of this river up to the parallel passing through the village of Sapeliga. It then skirts on the north the lands belonging to Sapeliga as far as the river Nuhau (Nouhau), which it follows up or down stream, as the case may be, to a point two miles east of the road from Gambaga to Tenkrugu *viâ* Bawku, whence it rejoins by a straight line the eleventh parallel at its intersection with the road leading *viâ* Djebiga from Sansanné Mango to Pama. This point is also on the boundary agreed upon by the French and Germans (see p. 39).

The new boundary in the Niger region also begins at the ninth parallel, where this parallel is intersected by the river Ocpara. Thence it proceeds in a northerly direction, passing to the west of Tabira, Okuta, Boria, Tere, Gbani, Ashigere, and Dekala. From the most westerly point of the lands of Dekala it runs in a northerly direction till it strikes the Niger ten miles above Gere, the port of Ilo. It then runs up the river, about seventeen miles as the crow flies, to the dry watercourse called Dallul Mauri, which it follows to the circumference of a circle of 100 miles radius, having the town of Sokoto as its centre. This circumference then defines the boundary as far as its second intersection with the parallel of 14° N. The parallel forms the boundary for seventy miles eastwards; then the line runs due south to the parallel of 13° 20′, then eastwards for 250 miles, then it returns due northwards to the 14th parallel, which it follows till it meets, in Lake Chad, the meridian passing 35′ east of the town of Kuka, this meridian limiting the British territory down to the southern shore of the lake. This it reaches at the Anglo-German boundary (see vol. x. p. 38). All the shore of Lake Chad from the 14th parallel round by the north to the Franco-German boundary at the mouth of the Shari is recognised as French.

The British Government will also lease for a term of thirty years to the French Republic two pieces of land, each neither less than 25 acres, nor more than 124 acres in extent, with a river frontage of not more than 438 yards. These are to be used for the storing and transhipment of goods only, and to be selected by the French Government, and will be situated, the one at one of the mouths of the Niger, and the other on the Niger between Liaba and the confluence of the Mussa river.

German South-West Africa.—A railway is being constructed to Windhoek from the coast. The starting-point is the settlement Swakopmund, founded by Von François on a terrace thirty to forty feet above sea-level and about one and a quarter miles north of the mouth of the Swakop river. Though there is only an open roadstead at Swakopmund, Lieut. Schwabe (*Deutsche Kolonialzeitung*, Dec. 4th) claims that the site has several advantages which Walfish Bay does not possess. There are no sand dunes at Swakopmund, whereas Walfish Bay is begirt by a zone over four miles wide; at the former place good and clear river water can be obtained at a distance of a little over half a mile, while the nearest drinkable water, and that very bad and brackish, lies more than two miles from Walfish Bay. Here also there is no pasture nearer than Haigamkab, thirty-four miles, and Usab, thirty-seven miles, where also are the nearest watering-places on the way into the interior. At Swakopmund there is fodder for a few animals within three-quarters of a mile, and the nearest watering-place on the inland route is

NEW ANGLO-FRENCH BOUNDARIES IN WEST AFRICA.



The Edinburgh Geographical Institute

J. Bartholomew

Scottish Geographical Magazine 1898

about six miles distant and is succeeded by others at no long intervals. The British line cannot be carried beyond the limits of the territory, the Dupas mountain, where there is no water, and which is nearly sixteen miles from the nearest source, at Usab.

The landing of goods at Swakopmund is exceedingly troublesome owing to the heavy surf and a current that flows up from the south along the coast. Frequent fogs and rocks increase the difficulty and danger. Current, surf, and the discharge of the neighbouring river cause continual alterations on the coast, the river bringing down large quantities of sand in seasons of unusual rainfall. Another difficulty that can only be removed by the construction of the harbour is that European sailors cannot take the boats safely through the surf, while the Kroomen suffer severely from the climate, which is too severe for them. When a harbour is finished Hottentots can be employed in their place.

At first it seemed impossible that the German settlement should ever compete with Walfish Bay, and at the end of 1894 the trade of the latter place was considerably greater. But Lieut. Troost had a steamer built in Germany which was brought out to ply between Cape Town, Angra Pequena, Walfish Bay, and Swakopmund, whereupon the British steamer *Nautilus* made Port Nolloth the termination of its voyage. Lieut. Schwabe suggests that Walfish Bay may some day be silted up, as has happened to Sandwich harbour.

AMERICA.

Kite Ascensions at Blue Hill.—Mr. S. P. Fergusson describes, in the *Monthly Weather Review* for September 1897, the two highest ascensions made from the Blue Hill Observatory. On September 19th the meteorograph was raised by a set of kites to a height of 9885 feet above sea-level (9255 feet above the summit of the hill). The meteorograph left the ground just after noon, reached its highest point at 4 h. 17 m., and returned to the ground at 6 h. 40 m. Stops of fifteen minutes were made after every 500 mètres of line were let out or reeled in, and a stop of twenty minutes near the highest point. The records obtained were very satisfactory. The temperature at the highest point was 37·6°, while at the Observatory it was 63°, the rate of fall being more rapid below the height of 2000 mètres (6560 feet) above sea-level than above it. The relative humidity rose rapidly up to 700 mètres (about 2300 feet), while between 900 and 1400 it was less than at the Observatory. Between 1450 and 1900 mètres it was very high, falling again at 2100, rising slightly at 2200, and falling once more at 2400. Above 2500 the humidity was very low, going down to 26, and probably lower—the record was defective at this height. The wind on the ground blew from the south-west, varying in velocity from nearly 30 miles an hour at noon to 20 miles at 6 P.M. With increasing altitude the wind became more westerly, and above 2000 mètres was almost due west.

Another ascent was made on October 15th, the meteorograph attaining a height of 11,086 feet above the hill, or 11,716 above sea-level. It left the ground at 3 h. 48 P.M., reached its greatest altitude at 6 P.M., and came to the ground again at 9 h. 20 P.M. The record, one of the best that has been obtained, is reproduced in facsimile in the *Weather Review*. The temperature at the highest point was 41°, while at the Observatory it was 72°. The passage of the meteorograph through the cumulus and alto-cumulus cloud-levels was shown by an increase, followed by a decrease, of humidity at heights of 1500 and 2800 mètres. On the ground the direction of the wind was south-west, and the velocity varied from 13 to 22 miles an hour. Above 1000 mètres it blew from the north-west.

Submerged Valleys on the Californian Coast.—Professor George Davidson has contributed a paper on this subject to the *Proc. of the Cal. Academy of Sciences.* Along the Pacific coast the sea bottom descends to depths of 2000 to 2700 fathoms within fifty miles from the shore. There is generally a ten-mile platform sloping out to the 100-fathom contour, and the edge of this platform is broken by twenty-seven submerged valleys. Sometimes the notches are in a line with rivers on land, as at Monterey and Carmel, but in some cases they appear to be quite independent of existing drainage, as opposite King Peak and San Pablo. The possibility that certain chasm-like valleys, such as that of Vincente, result from dislocations, seems to be excluded by the evenness of the littoral plateau on either side of the chasm. The real origin of the valleys can only be decided after they have been studied in connection with the structure, form, and drainage of the neighbouring land. It cannot, however, be assumed that they must have originated from continental movements, for the Earth's crust may bend beneath the sea as well as on land.—*Science*, April 22.

Indian Territory.—The following details are taken from a note in *Science*, April 22nd, on a thesis presented by Mr. N. F. Drake to the geological department of Stanford University. The Ouachita system extends into the Territory south of the Arkansas and Canadian rivers in sharp monoclinal ridges on close-folded structures and flat-topped mountains, often synclinal in structure, where the folds are more open, all trending east and west. A plateau with broad uplands and narrow valleys enters from the Ozark region on the north-east and stretches as far as the Grand and Arkansas rivers. The Great Plains enter from the north-west into the angle between the Grand and Canadian rivers, an extended area of moderate relief descending gently eastwards, and here and there falling in terrace-like escarpments 50 to 100 feet high as the harder strata are passed.

Clipperton Atoll.—Admiral Sir W. J. Wharton has communicated to the Geological Society a note on the formation of this island, of which a short description was given on p. 155. In several respects Clipperton resembles many other islands of the same type, but it is remarkable from the existence of a massive rock about 60 feet high, not near the centre of the lagoon, but on the rim itself. Admiral Wharton received from Mr. J. Arundel some specimens of rock from the island, supposed to be a mixture of volcanic material and coralline limestone. When the paler specimens, however, were tested by Mr. Teall, they did not effervesce with acid, and could not therefore be unaltered coral rock. In fact, all the specimens turned out to be trachyte, the paler having been to a greater extent chemically changed by the phosphates washed in from the guano. The depth in the lagoon is very great for so small an atoll—20 fathoms were sounded by Mr. Arundel, and this probably is not the maximum—and Admiral Wharton believes that we have here the rare case of coral forming on the lip of a volcanic crater. As at Krakatoa a large part of the island was blown away, leaving part of the margin of the vent rising up on one side of the deep hole thus formed, so a similar convulsion, leaving a plug on one side of the crater hollow, might explain the existence of the Clipperton rock.—*Quarterly Journal of the Geol. Soc.*, vol. liv. part 2.

The Rio Capim.—In June and July 1897 Dr. Emil A. Goeldi, on behalf of the Museum for Natural History and Ethnography in Pará, led an expedition up this river, which, though it enters the Tocantins close by the town of Pará, is still one of the least-known rivers of the State. In past centuries Europeans must have been much better acquainted with its banks, for the Portuguese had to send out expeditions to punish the Indians who frequently attacked the settlements. Dr.

Goeldi, with a botanist, Dr. J. Huber, ascended in a steamer to the estate of the Vicomte Chermont de Miranda at Apronaga, seventy-six nautical miles up the river, making the journey, with the assistance of the spring tide, in the short space of nine hours. Hither they were followed by the steamboat *Ondina*, which had been chartered for the expedition. Starting early on June 24th, they ran aground at the Sete Ilhas (seven islands), where the stream is broad and shallow, and late at night arrived at the Sitio São Luiz, the property of Major Ayres. The river makes six windings in this distance, most of which are not sharp, and runs on the whole north-north-east. At the picturesquely situated São Luiz it becomes much narrower and correspondingly deeper and swifter. The tide does not ascend farther than the Sete Ilhas. Next day the party passed the mouth of the Candiru-açu and reached Cupijo-Tapera, an abandoned Indian settlement. The river makes in this part of its course many sharp bends and turns, and high ridges coming down to the banks form narrows and gorges. From São Luiz to the Candiru the general direction is nearly due north, from the Candiru to the *igarape* Amanahy north-east, and thence to Cupijo north-north-west. It then runs north to the Polyreta, where it makes a decided turn to east-north-east. At Acaryuçana, the most advanced settlement of the Tambe Indians, the party were at a distance of 47⅔ hours' steaming from Apronaga. The Indians are employed in the felling of timber (*Cedrela*), which is sent down in large rafts to Pará for export, and in the collection of copaiva oil. The next day, the 28th, the steamer reached about 10 A.M. the lowest rapid. This could have been passed, but an examination made in a boat showed that the second rapid was not deep enough for the *Ondina*, and accordingly the voyage came to an end here. On the journey down, which from Acaryuçana was accomplished in canoes, several halts were made for the collection of natural and ethnographic objects. Near Tracuatena a lake was explored, separated from the river by a ridge only 85 yards broad. There are many similar lakes along the upper course of the Capim; they are evidently the remains of a period of high water.

Dr. Goeldi had no instruments for the exact determination of position, but he believes that he ascended the Capim to a point in about 3½° S. lat. and 5½° W. long. from Rio de Janeiro (about 48° W. of Greenwich). He counted twenty-nine tributaries on the left bank between Apronaga and Acaryuçana, and twenty-six on the right bank. In the upper part of the river the banks increase in height, and the wooded spurs slope steeply down to the water on either side alternately, faced by a flooded forest on the opposite shore. Sandstone extends over the whole stretch, composing the ridges that form the rapids above Acaryuçana. Were it not for these rapids, which could probably be removed at no great cost, there would be an uninterrupted waterway to the borders of the State of Maranhão, for the Surubiju is said to be deep and navigable for a long distance. The other headwater, the Araradena, is said to be broad but shallow and full of rocks.—*Petermanns Mitt.*, Bd. xliv. No. 2.

Surface Temperatures of Lake Titicaca.—Professor R. De C. Ward publishes in *Science*, Jan. 7, some observations made during a steamboat trip from Puno, at the western end of the lake, to Chililaya, a small village at its southern extremity. The latter is about 100 miles from Puno, and is the landing-place for passengers going to La Paz. At 8 a.m., Nov. 26, at the wharf of Puno the air temperature was 56° and the water 60·9°. During the remainder of the day the temperatures were as follows: 9 a.m., air, 50°; water, 59·5°: 10 a.m., air, 53·2°; water, 59°: 11 a.m., air, 51·8°; water, 57·2°: 12 m., air, 51·2°; water, 57·7°: 1 p.m., air, 50·9°; water, 57·9°: 2 p.m., air, 54·2°; water, 58·2°: 3 p.m., air, 54·8°; water, 58·3°:

4 p.m., air, 54·1° ; water, 57·9° : 5 p.m., air, 49·8° ; water, 57·9° : 6 p.m., air, 53·5° ; water, 57·8°. There was a fresh breeze from the north-east and scattering cirrus clouds or clear sky over the lake. Noticeable facts are the higher temperature of the water near the shore, where the lake is shallow, and in the land-locked bay of Puno ; the slight diurnal variation, reaching a maximum at 3 p.m. ; and the higher temperature of the water relative to that of the air.

During the return journey, on Nov. 28, the sky was overcast throughout the day. Light south-east wind or calm prevailed up to 11 a.m., when the wind changed to north-east and gradually increased in velocity up to twenty-five miles an hour. The water temperatures rose up to 11 a.m., after which, probably owing to increased cloudiness and the change in the wind, a fall occurred in the temperature of the lake. The air temperature was below that of the water, except at 2 p.m. (in Puno bay) when the temperature of the air was 62·1°, and of the water 60·4°. As on the outward trip, the bay was warmer than the main body of the lake.

It was very noticeable that the cumulus clouds were over the land, where the rapid warming of the surface gave rise to ascending currents of air, and not over the lake, above which clear sky, or only light cirrus, was observed. The cumuli were also better developed over the eastern shore, where the mountains are higher than on the western.

Probably the lake exercises a considerable influence on the climate of the immediate vicinity, but as the meteorology of Titicaca has not yet been carefully studied, nothing definite can be said of this influence.

The Boundaries of Bolivia.—It has been stated before in this journal that the north-western boundary between Bolivia and Brazil was, by the treaty of 1867, defined as running from the confluence of the Mamore and Beni, which form the Madera, along the parallel of 10° 20′ to the source of the Yavari, but, if the source of the latter river should lie farther to the north, then the frontier was to follow a straight line from the source to the Madera in lat. 10° 20′. The Brazilian and Peruvian mixed commission in 1874 fixed the principal source of the Yavari in lat. 7° 1′ 17·5″ S. and long. 74 8′ 27·7″ W., and this position was assumed as correct by the Brazilian and Bolivian Governments in 1895. In accordance with these stipulations the boundary has been marked on the banks of the rivers with pillars (*hitos*) by a joint commission. On the Acquiry the stones stand at long. 67° 30′ 17·5″ W. ; on the right bank of the Hyuacu at 68° 38′ 53″ W. long. and lat. 9° 8′ 13·5″ S.; and on the right bank of the Upper Purus at 8° 57′ 27″ S. lat. and 69° 7′ 31″ W. long. According to the *Bulletin of the American Republics*, the result of the delimitation will be that a million dollars a year will flow into the Bolivian treasury which hitherto the Brazilian Government has levied as export duty on indiarubber.

Towards Peru, Bolivia claims as its boundary the right bank of the Inambary down to its mouth in the Madra de Dios, and a straight line running thence to the source of the Yavari in lat. 7° 1′ 17·5″ S. lat. The preliminaries are, however, not yet settled between the two republics. Peru claims all Peruvian settlements east of this line ; and, besides, the identity of the Inambary river is still undecided. In the Bolivian province of Caupolican is situated the town of Pelechuco on a stream of the same name which, descending from the cordillera of Pelechuco, enters the Tuiche, an affluent of the Beni. On the eastern side of the cordillera rises the Tambopata, supposed to be the Madidi ; while on the western side the two streams Sina and Quiaca unite with the Sandia to form the Huari-Huari, which, after receiving the San Gaban, assumes the name Inambary. But the hydrography of this region is not based on reliable data, and therefore Major

Pando set out in May 1897 for Apolobamba, whence he marched with part of his men for fourteen days to a stream descending from the mountains between the passes of Sina and Pelechuco, which he named the Rio Lanza. This stream, which is navigable, though rapid and encumbered with sandbanks, unites lower down with the Saqui, called also incorrectly the Tambopata. While Pando was navigating the Lanza, another detachment of the expedition under a French engineer, Varnoux, proceeded to measure the highest summits of the cordillera, and, entering Peruvian territory at the river Sina, caused wild excitement in this republic, where it was spread about that Pando had invaded the province of Sandia with six hundred Bolivians.—*Cuestion de Limites entre Peru and Bolivia*, por A. Iturralde, and *Globus*, Bd. lxxiii. Nov. 2.

MISCELLANEOUS.

The railway from **Samarkand to Andijan** (see vol. xii. p. 317) is now completed.

China has granted to the British Government a lease for 99 years of the mainland behind Kau-lung, opposite **Hongkong**, as far as a line drawn from Deep Bay to Starling inlet, Mirs Bay, as well as of Lan-tao and the other smaller islands lying off the coasts of Lan-tao, Hongkong, and the mainland.

By the prolongation of the **Luleå-Gellivara** railway to Victoriahavn, on the Ofoten fiord, the construction of which has lately been decreed, the northern parts of Norway and Sweden will be connected with an ice-free port on the Atlantic coast. Such a connection will be of especial importance to the iron industry. The line is to be completed in 1903.—*Geogr. Zeitschrift*, Heft 5.

The great steel arch bridge which is being built across the gorge at **Niagara** falls, to replace the suspension bridge, will be the largest of its kind in the world. The length of the main span is 868 feet, and it will be connected with the cliffs by two flanking spans, one on the New York State side of 190 feet in length, and the other on the Canadian side of 210 feet, making the total length 1268 feet. The floor, about forty-nine feet wide, will have a double track for an electric tramway in the centre, and carriage roads each eight feet wide and footpaths on either side.—*Canadian Gazette*, May 19th.

Dr. Hans Meyer started last month on his third **Kilimanjaro** expedition. In 1887 he ascended the Kibo peak as far as the mantle of ice, 18,000 feet above sea-level, and in 1889, accompanied by Purtscheller, he reached the crater edge and named its highest point the "Kaiser Wilhelm Spitze." Though a number of other explorers have visited the mountain since then, the northern side is still imperfectly known, and the former glaciation of the mass, the distribution of Alpine plants etc., require further investigation. The Mawenzi crater also will reward closer examination.—*Globus*, Bd. lxxiii. No. 21.

The **Edinburgh Summer School**, which will be held this year from August 1st to 27th, will henceforth be designed chiefly for the study of modern languages. English and French will be taken up at this meeting, but it is hoped that other languages may be introduced in future years. The programme will include lectures on the social life and institutions of Great Britain and France, and their literature, classical and contemporary, as well as a course on the teaching of modern languages, conversation classes, etc.

The secretary is Mr. T. R. Marr, Outlook Tower, University Hall.

Mr. R. C. Mossman has compiled for the Journal of the Scottish Meteorological Society tables showing the occurrence of the **Aurora Borealis** in London from 1707

to 1895. The average number observed yearly was 2·4. The maximum observed in a single year was twenty-nine, in 1848, and the next largest numbers were twenty-three in 1787, and twenty-one in 1789 and 1872. The maximum observed in one month was eight, in October and also in November 1848. A curve formed by bloxaming the annual values in threes show that maxima occur fairly regularly every eleven years. Auroras are frequent in October and April, and rare in December and June.

The **Baltic and Black Sea Canal**, mentioned in vol. xi. p. 540, is this year commenced. Its breadth at the surface will be 213 feet, and at the bottom 115 feet, and the average depth is to be 28 feet. From Riga as far as Dunaburg the river Dwina provides a natural waterway. Hence a canal must be made to Lepel on the Beresina, along which vessels can pass to the Dniepr, and so to the Black Sea. Thus, out of a total length of nearly a thousand miles, only along some 125 miles will an artificial canal be necessary. By the regulation of various rivers a large number of towns such as Disna, Mozyr, Chernigof, Oster, and Poltava will be connected with the canal. The time allowed for the construction is five years.—*Verhandl. der Gesell. für Erdkunde zu Berlin*, No. 4.

No nation has at yet laid formal claim to the possession of **Spitzbergen**. The Swedes and Norwegians, however, look upon it as part of the Scandinavian kingdom, as it lies nearest to their coasts and has been explored chiefly by them. Lately the Russians have put forward some claim to the group in consequence of the invitation of the Swedish Government to join in the measurement of an arc on Spitzbergen, the acceptance of which would, it is considered, be an admission of the rights of Norway and Sweden. The group, with an area of some 27,000 sq. miles, is, though uninhabited, by no means valueless, being rich in minerals—coal, iron, marble, and graphite; the existence of gold is also inferred from many indications. The seal and other fisheries are of great importance, and demand State regulation to prevent their total extinction.—*Geogr. Zeitschrift*, Jahrg. iv. Heft 5.

Atlases frequently contain maps showing the hemispheres embracing the maximum areas of **land and water**, but the pole of the land hemisphere is usually some European capital—Paris, London, or Berlin. Prof. Krümmel of Kiel has sought to obtain the most correct position by using an Antipodes map on the gnomonic projection, in which all great circles are represented by straight lines. He then, stretching over the map a thread, seeks to find by trial the line which includes the least combined areas of south-east Asia and South America, counting the one-degree spaces, and estimating the fractions. The pole is found with the aid of a globe, or by a mathematical calculation. One of the Professor's pupils has applied this method, and has ascertained that the favourable positions for the pole of the land hemisphere lie in the Bay of Biscay, the best being at Le Croisic, not far from the mouth of the Loire.—*Petermanns Mitt.*, Bd. xliv. No. 5.

NEW BOOKS.

Aus Lydien. Epigraphisch-Geographische Reisefrüchte, hinterlassen von Karl Buresch. Herausgegeben von Otto Ribbeck. Leipzig: B. G. Teubner, 1898. Pp. 226. *Price M.* 14.

The author of this posthumous work was a native of Hanover, who died in 1896 at the early age of thirty-six years. After being instructed in the Humanities in the Oldenburg Gymnasium, he entered Marburg University, which he soon left

to enter that of Leipzig. Here at first, under the influence of Conrad Hildebrand, he was powerfully attracted to Germanistic studies, but eventually the subject to which he devoted himself was classical philology. What turned his energies in this direction was the circumstance of his writing an academic prize essay entitled, *A Critical History of the Greek and Roman Treatises on Consolation* (Trostschriften). In 1886 this essay appeared as his dissertation for the Doctor's degree. Its composition opened up to his view a wide field of classical literature, and gave him abundant scope for critical investigations of a most searching character. In his vacation terms he joined his family, which had removed to the delightful seaport town of Kiel, and there he spent most of his leisure in sailing along the shores of the bay and its narrow fiords. Just at this time Breusing's *Nautik der Alten* made its appearance. Buresch having read it with keen interest, set himself to examine minutely the sources whence its facts had been derived, and during his year of military service (1887) wrote a clear and masterly review of the work which gained for him the admiration and friendship of the author. Towards the end of the same year, when he had not as yet fixed on a career, he met at Leipzig a former fellow-student, Conrad Cichorius, who had been to Asia Minor, and was then making preparations for returning thither. Buresch having accepted a proposal to join him, the two friends started on their excursion in April 1888. In the course of their wanderings they explored not a few of the most interesting localities in *Kleinasien*—among others, such places of old renown as Nicomedia, Nicæa, Lake Ascanius, on which that city stood, Prusa, Mount Olympus, Apollonia, Lesbos, Smyrna, and Mount Sipylus with its petrified figure of the weeping Niobe. In Lesbos our travellers had the good fortune to meet with Herr H. Kiepert, and to spend some time with that eminent cartographer in an exploration of the interior of Sappho's island-home.

Among the more important results of this first excursion was the discovery of two Greek inscriptions, which, singularly enough, belonged to the class of the so-called consolation decrees (Trostdecrete), and the discovery also of the old city of Cæsarea Troketta on Tmolus, and of a remarkable dedicatory inscription with oracle verses of the Clarian Apollo written in a variety of metres. Upon all these inscriptions Buresch wrote dissertations and notes which showed wide and accurate erudition. A further result of the excursion was that it shaped the course of Buresch's subsequent life. Asia Minor, and especially Lydia, with all its classical memories—Gyges and Crœsus, the Pactolus with its golden sands, the Mæander in "mazy errors lost," the Cayster with its Asian mead and its swans, Mount Tmolus, the fabled haunt of Dionysus and his Mænads—these all so fascinated him that he resolved to devote himself thenceforth to the investigation of its geography and its archæology in order to reconstruct, as far as might be possible, its past history. Another attraction which these classic lands possessed for Buresch lay in the beauty of the scenery and the softness of the climate. "Kleinasien," he said, is wondrous beautiful, and it ofttimes answers to my idea of what lost Paradise must have been." Accordingly he returned to it in 1891, and setting out from Smyrna spent the three autumn months in exploring parts that had been previously quite unknown. He discovered inscriptions, all the more readily as he could make inquiries either in the Greek or Turkish language, which he spoke as fluently as the natives themselves. On this excursion he over-exerted himself, to the serious injury of his health. In 1893 he visited Troy, and, having there met with Dörpfeld, visited along with him Samothrace, Pergamus, and Smyrna. In 1894 he was again in Lydia, and on this occasion was nearly drowned in crossing the Lycus, in the district of Thyatira. In the following year he was again in Lydia, and for the last time.

The volume, we have said, is posthumous. It was printed under the editorship of the author's friend Otto Ribbeck, from MSS. left ready for publication. It consists of two parts, the first containing the inscriptions which Buresch had discovered in the course of his explorations, and his remarks upon them. They date for the most part from the early Christian centuries. Many of them are imperfect, but our author has endeavoured to restore as far as possible what has been obliterated. The inscriptions are arranged according to the locality in which they were found in seven groups as follows :—1. The region between Mount Tmolus and the rivers Hermus and Kogamus ; 2. The Hyrcanian plain ; 3. The region north of the middle course of the Hermus ; 4. Mæonia, or the region between the Hermus and the Kogamus ; 5. The region of the rivers Pge Ischai and Selendi Ischai north of the Hermus ; 6. The eastern part of Lydia ; 7. The region of the Upper Caÿster. The second part has more interest for the general reader as it contains Buresch's account of the various journeys he made through Lydia during his last visit to that country in 1895, supplemented by the reports which he had supplied to the Royal Scientific Society of Saxony of his travels in 1891 and 1894. These papers are full of important matter for the geographer and the map-maker, the value of which cannot well be overrated. Much has been done of late years for the exploration of Asia Minor, but a vast deal yet remains to be done, and one cannot but regret that so enthusiastic and indefatigable an explorer in that field should have been cut off in the noontide of his days.

Everyday Life in Turkey. By Mrs. W. M. RAMSAY. London : Hodder and Stoughton, 1897. Pp. 303. *Price 5s.*

Following upon Professor W. M. Ramsay's book, *Impressions of Turkey during Twelve Years' Wanderings*, which appeared less than a year ago, this volume by his wife gives vivid and lifelike pictures of the country and its inhabitants through which they travelled. As their journeys were made chiefly on horseback, often through isolated villages and remote inland towns, completely cut off from modern means of communication, and therefore from the modern western world, where the appearance of strangers, especially of the writer's sex, excited keen interest and curiosity, Mrs. Ramsay and her husband had frequently repeated opportunities of observing the customs, habits, and domestic life of a number of small communities of varying races little known to the ordinary traveller. Her record of their experiences is set down with a racy energy of style, rising into dignified impressiveness when dealing with subjects such as that of the God in the Glen (chapter vi.). The writer's interests, too, are very varied. Nature and human nature rouse her sympathetic observation, while her references to the historical and archæological researches made by her husband show that she kept thoroughly abreast of the main objects of these expeditions.

Two points brought out by Mrs. Ramsay strike us as important as a corrective to the generally received impressions of Turkey. One is that of the relations of Mohammedan husbands and wives, which Mrs. Ramsay speaks of as being, so far as her experience has gone, frank and pleasant ones. Instances of brutality on the part of a man towards his wife are, she says (and for our part, we are quite inclined to agree with her), "a hundred times commoner among the lower classes of this country than they are in Turkey." The other point is that of distinguishing between the Turkish people and the Turkish Government. In this connection she says—"I have lived in the country, and have travelled in it, and have found the people always simple, peaceable, hospitable, and friendly—living amicably with their Christian neighbours, at least as much oppressed by the bad government as they

are—often more so. . . . Not the least of the crimes charged against the present Sultan is, that he has set the worst class of Turks above the best, and stirred up among his Mohammedan subjects religious hatred and evil passions."

This volume may be said to be complementary to that of Professor Ramsay's above referred to, containing as it does many details of family life, peeps into the interior of the harems, and descriptions of their occupants, which could only have come under feminine eyes. The same tone of sympathetic impartiality towards Turks, Armenians, Greeks, Albanians, Circassians, which distinguished Professor Ramsay's book, is characteristic also of the present volume. In all her portraits of Moslem and Christian alike we feel that touch of nature which makes the whole world kin. Any one who has known the difficulties of learning something of the domestic life of the Turks, and who has been struck by the ignorance in this respect of even those Western Europeans who have lived long amongst the Turks, will know how to appreciate at their true worth these first-hand accounts of Eastern life. One may be inclined to think that the extracts from the diary might with advantage have been slightly compressed, thus avoiding, on the one hand, a little repetition, and, on the other, omitting some details unimportant to the subject of the book; and one is tempted also, when one's geography is at fault, to wish that a map of the district visited had been inserted. But these are trifling criticisms, and we can heartily recommend Mrs. Ramsay's book as being not only very pleasant and often amusing reading, but also a valuable help towards an understanding at once of the charm and romance of Eastern life, and the (to us Westerns) well-nigh hopeless passivity and fatalism of it.

South Africa of To-day. By Captain Francis Younghusband, C.I.E., etc., late Special Correspondent of *The Times* in South Africa. London: Macmillan and Co., 1898. Pp. 177. *Price* 8*s.* 6*d. net.*

The opportune appearance of Captain Younghusband's book will be hailed with interest by students of the South African history of to-day, and his descriptions of the scenes in the Transvaal are well supplemented by letters and telegrams to *The Times*, and are full of life and reality. The composition of the two great parties in the Republic is well set forth, but it is sometimes difficult to see to which side the author's sympathies incline, as high encomiums are passed on Mr. Kruger, Mr. Rhodes, the Jameson raiders and the Johannesburg leaders, alike.

Uninteresting as the Boer may be to most people, there is an element of romance in his history. A small band of Dutchmen, leaving their native land to avoid persecution, settled at the Cape, and one hundred years later many of their descendants joined in the "Great Trek" of 1836 rather than submit to British rule. Now they present the anomalous spectacle of a small minority ruling over double their own number of white men, and ten times as many blacks, by a system of government about the most despotic of modern times. Against this our author raises his voice; but, while undoubtedly the case of the Uitlanders is very hard, yet, on the other hand, were they once to obtain the franchise, the Boers might prepare for a second "Great Trek," which at his time of life Mr. Kruger is not likely to contemplate with satisfaction. By his present policy the prosperity of the owners of the soil will, at any rate, be secured as long as the gold lasts.

Much of this book, however, is devoted to prove that the Transvaal need not live by gold alone, and we are inclined to indorse the author's view that, should the gold "pinch out," the other vast natural resources of the country—wood, coal, iron, and unlimited agricultural possibilities—will tend not only to attract immigrants but also to ensure their remaining permanently. As regards the gold, though we

cannot accept the author's humble opinion of himself that he knows nothing about it, we cannot help thinking that his views are very optimistic.

The various traits of Boer character are well brought out, and while their "capacity for military co-operation," and their excellent fighting qualities evidently commend themselves to the sympathies of the author, their weak points are not glossed over, and evidence of the national untruthfulness and hopeless unprogressiveness is frequently apparent.

And now arises the question, How long is this tyranny of President Kruger, supported by his recent numerous majority, to last? for on that depends, primarily, the future outlook of affairs in the Transvaal. The action of the Raiders and the five Patriots at Johannesburg, while actually fulfilling Sir Charles Dilke's remarkable prophecy in 1890, that "within six years Kruger would have to grant concessions or face a revolution," was assuredly the means of delaying reforms for an indefinite period. Hemmed in, however, as the Boer is by civilisation on all sides, he cannot long withstand its advancing waves, while railways, marriages of Boer girls to British subjects, and pressure from us and other European states, must in the long-run bear their natural fruit in the shape of a South African Republic, but whether under the Dutch or British flag it would take a cleverer prophet to predict than even the author of *Greater Britain*.

The situation in Rhodesia is another South African problem which is treated in an able and masterly way. The chief incidents of the memorable rising of the natives are tersely related from the descriptions of men who told their experiences while they were fresh in their memories. It is a relief to turn from these horrors to the present aspect of Rhodesia. The probabilities of another outbreak are infinitesimal, and the rulers have the advantage of being, as yet, more or less unfettered by grandmotherly legislation from home, while all classes alike look up to the "great white chief who exercises by his personality such a wonderful influence over them."

Through South Africa. By Henry M. Stanley, M.P., D.C.L. London: Sampson Low, Marston, and Company, 1898.

This volume contains a reprint of the letters written by Mr. H. M. Stanley to the *South Africa* newspaper. The letters were contributed during an expedition to Buluwayo and Johannesburg in the winter of 1897, when the famous African explorer had been invited to be a guest at the celebration of the arrival of the Great Peninsular Railway at the capital of Matabeleland. It is unnecessary to tell our readers that his description of the country he passed through is graphic and interesting, or that he gives a very entertaining account of his journey through a comparatively monotonous and uninteresting country. His name is a guarantee for a crisp, vigorous, and incisive style, and for picturesque and faithful description. Even those who have read several of the many books on the subject will welcome another from the pen of the author of *Through the Dark Continent*.

But the main interest of these letters is political. Mr. Stanley has described at considerable length the present condition and future prospects of Rhodesia, and he has recorded in the plainest language his opinion of the *status quo* at Johannesburg. With regard to Rhodesia, he anticipates for it a magnificent future, not so much from its gold as from its agricultural wealth and resources. He points out that what is wanted for its development is more white population, farmers and agriculturists rather than diggers and miners, and more attention to the storage and distribution of water. The high land of Rhodesia, *i.e.* the lands free from malaria, "which is eminently suitable for European families, is about seventy thousand square miles in extent, of solid unbroken agricultural country as com-

pared with Ireland, Scotland, and Wales." At another time he said to an interviewer: "The best work the British Government ever did was in sending those five thousand English people to South-East Africa in the early part of this century. The experiment, unfortunately, has never been repeated. . . . It seems to me that there ought to be three or four hundred families going out every week to settle in new homes." With regard to the *status quo* at Johannesburg, Mr. Stanley adopts the judicious and easy plan of blaming everybody. He blames the Boers, he blames the Uitlanders, he blames the Colonial Secretary and the Colonial officials, and above all he blames Mr. Krüger. In writing of the last mentioned he seems to us to have transgressed the ordinary rules of good sense, as well as those of good taste. Here is his description of what he calls "the Presidential dotard," after the dotard had given him an interview: "In appearance he is only a sullen, brutal-looking concierge, dressed in old-fashioned ill-made black clothes. He appears to know absolutely nothing outside of burgherdom; he has neither manners nor taste; his only literature seems to be limited to the Bible and a few treaties and documents about the Republic; he has no intrinsic excellence of character that should appeal to the admiration of the public; but what he does know, he knows well. . . . His disposition, morose from birth, breeding, isolation, fostered by contact with his kind, is unyielding and selfish, and has been hardened by contempt of the verbose weaklings who have measured themselves against him. . . . Though the President reads the Bible daily, he must have overlooked the sentences that apply to liars. . . . The real Krüger is a Boer Machiavelli, astute and bigoted, obstinate as a mule, and remarkably opinionated, vain and puffed up with the power conferred on him, vindictive, covetous, and always a Boer, which means a narrow-minded and obtuse provincial of the illiterate type." It is to be regretted that these interesting and useful letters have been disfigured by such language, which is all the more to be deprecated when it comes from the pen of a distinguished writer and an English M.P.

A History of Canada. By CHARLES G. D. ROBERTS. London: Kegan Paul, Trench, Trübner, and Co., 1898. Pp. xi + 493. *Price* 10*s.* 6*d.*

In this extremely interesting and well-written book the author has divided the history of Canada into three parts. The first is that of the French dominion, which ended with the famous battle of the Plains of Abraham, or, more accurately, with the Treaty of Paris of 1763. The second is the period of English dominion, before the colony became an united confederation, and ended with the passing of the British North America Act in 1867. The third he names the Confederation period, and it consists of the last thirty years. The convenience of the arrangement is obvious, and it fits in well to what is evidently the profound belief of the writer, viz., that the history of Canada has often been the history of Europe. He strikes this keynote in his first paragraph, which may be quoted as a good illustration of the author's literary style. "The stage on which the drama of Canadian history unfolds may seem to the world an obscure one. A closer view, however, will reveal that on this stage some of the gravest problems of history have been pressed to a solution; and we may reasonably expect to find in this drama an answer to some of the weightiest questions of modern politics. Battles were fought on the Rhine, the Elbe, the Danube; German, Austrian, Spanish thrones were shaken to their fall; navies grappled in the Caribbean Sea, and Mahratta hordes were slaughtered on the rice-fields of India, to decide the struggle which ended only upon the Plains of Abraham. Now, in these imperial domains which Wolfe's triumph secured to British sway, a people is taking shape which bids fair to combine the power and genius of the two great races from which it springs. In the

hands of this people it will perhaps rest to decide whether the empire of Greater Britain, built up with so much treasure, and baptized with so much blood, will split into pieces or be drawn into a yet closer and stronger union."

In treating the history of Canada as one of imperial rather than of local interest, the author has taken a very broad view of the importance of his subject, and we may congratulate him on having so successfully demonstrated to his readers that this view of Canadian history, at least before the Treaty of Paris, is absolutely correct. In perusing his vivid and often thrilling narrative of the struggle for dominion in Canada we never lose sight of the fact that success for England implied the collapse of France as a Trans-Atlantic Power, and *vice versa*.

But a few pages are devoted to the more or less mythical or conjectural history of Canada before the voyages of the Cabots and Cartier, and then the writer commences the real history of Canada, or, as it was originally called, "Acadie." It is, of course, quite beyond our limits to condense the story, even if it were fair to the author to do so. But we can assure our readers that the interest never flags from the first page to the last. The author has to set before his readers a great mass of detail, and this he has treated with a judicious sense of proportion. He is also quite impartial to friend and foe. Equipped with a graceful, easy, and clear style, he is equally successful whether he is narrating a fierce struggle between the English and the French on the shores of the St. Lawrence, or describing an almost equally fierce constitutional dispute between the colony and the mother country, or between the members of the confederation. In passing, we may observe that he brings out with unusual clearness and effect the astute wisdom with which the ferocious Iroquois Indians often joined in the wars, or held their hands, and so made themselves a third party whose friendship or enmity repeatedly turned the scale of fortune.

Although not concealing his opinion that the mother country often treated her Trans-Atlantic colony with unworthy distrust and shabbiness, the author does not indulge in invective or useless recrimination. On the contrary, he clearly points out to his compatriots, that however remarkable the development of Canada has been, and however great the promise of the future is, it has owed much to the mother country, and for the present at any rate must still maintain its connection with her, and rely on her for the protection of its thousands of miles of frontier by sea and land. The day may come when the Dominion will be able to stand alone and face its powerful and hungry antagonist on the south, but that day is as yet far off. In the meantime, the writer, like many other colonial statesmen, seems to look forward to a general federation of the British empire as the best solution of the problem of what is to be the future of Canada and the other British colonies and empire, and we may cordially acquiesce in his hope that Canada will lead the way in bringing about this grand ideal.

In future editions it would be a great improvement if the map which accompanies this volume were detached, and coloured so as to show lakes, rivers, boundaries, etc., more distinctly than they now appear. It should also be extended so is to include, at least, the valley of the Ohio.

Bibliothek der Länderkunde, herausgegeben von Alfred Kirchhoff und Rudolf Fitzner. Band I. *Antarktis.* Von Dr. Karl Fricker. Berlin: Schall und Grund, 1898. Pp. 230. *Price M.* 5.

The series of descriptions of the countries of the globe opportunely commences with the volume on the South Polar lands, now the subject of so much discussion, and the object of several expeditions, proposed or in course of organisation.

After defining the limits of the region he deals with, Dr. Fricker sketches the history of its discovery, and then collects the information on the individual islands and groups, in many cases unfortunately but scanty, to be found in the narratives of Antarctic voyagers. In the concluding chapters he treats of general subjects—climate, ice conditions, etc.—and ends with a useful list of books and maps.

Dr. Fricker, though he pleads in his preface want of sufficient time to do the subject justice, has carefully studied the records of explorers, and has grouped the facts judiciously. The bearing of the barometric records obtained on the atmospheric pressure round the Pole, for example, is very clearly set forth. The discovery of the South Shetlands by Dirk Gerritsz, and of South Georgia by Amerigo Vespucci, however, will not be generally accepted. There are, indeed, many points yet to be cleared up regarding the South Polar regions, and a work of this kind, which clearly sets before the reader what is already known, is most useful at the present time, when further discoveries are in prospect.

The book is illustrated with a number of views from the books of navigators, those of Dumont d'Urville being especially good from an artistic point of view. There is also a good map of Antarctica, and several sketch-maps of various parts. If the same standard is maintained in the rest of the series, these volumes will be a boon to all classes of readers.

Mungo Park. By T. Banks Maclauchlan. (Famous Scots Series.) Edinburgh and London: Oliphant, Anderson, and Ferrier. Pp. 160. *Price* 1*s.* 6*d.*

The thrilling character of Mungo Park's own account of his first great journey in Western Africa has been well maintained in this brief narrative of the daring enterprise, when, as a single traveller, without escort, and often near to starvation, he succeeded in penetrating to his goal, the Niger, through a people exceedingly fanatical and generally meanly inhospitable. The story stands out in marked contrast with the accounts of expeditions of modern times, strongly organised, and with every variety of equipment. We have as an introduction to the narrative of the journey a sketch of the early life and upbringing of the great traveller, in which can be traced the springs of his patient perseverance through sustained hardships, and indomitable perseverance to accomplish the mission on which he had been sent. The sad story of the second expedition, in which the single traveller returned as a leader, has not the romantic interest attaching to the first, but the ending of it all in the loss of the leader with the remnant of his followers, who survived to reach and to navigate the hitherto untracked Niger, as told through the investigations of subsequent travellers, furnishes a melancholy satisfaction in the present sketch of the life-work of a very remarkable man.

A few particulars of the journeys of other travellers in the same region of Africa are appropriately given in the concluding chapters.

Studies in Brown Humanity. By Hugh Clifford. London: Grant Richards, 1898.

Those of our readers who have perused Mr. Clifford's Malay sketches *In Court and Kampong* will be glad to receive another series from his facile pen. This second series, which he calls *Studies in Brown Humanity*, is in no way inferior to its predecessor, and undoubtedly the Malay does not improve on further acquaintance. Some of the stories are weird and gruesome enough to supply ample materials for a dozen high-pressure nightmares, and perhaps the most remarkable of all is the last, viz., "The Elopement of Chaling the Dyak," in which we are told how

a bridegroom was carried off by a lady orang-outang, and after various startling experiences in her company in her *nest* on a tree, succeeded in making his escape only by cutting her throat. The descriptions of Malay scenery and travel are as vivid and skilful as ever. We may specially invite attention to the powerful account of a march, if such a term may be properly applied to a journey in a canoe, through a submerged forest. After describing how the ordinary appearances of the forest had been totally changed by the fact that the leaves, twigs, branches, and trunks of all the trees and bushes were literally covered with ants, bugs, cock-roaches, etc., he goes on to say, "but the semblance of an enchanted wood was chiefly given by the snakes. Over and over again, as we skirted a tree or pushed past a low, hanging bough, a cruel lozenge-shaped head would dart out at us from among the foliage with wicked glistening eyes, and nimble protruding tongue. We could see others coiled up in the branches overhead, and several fell into the boat or splashed into the water around us during the course of the day. Now and then we would turn aside to avoid a water-snake wriggling along the surface of the flood, only to find another enemy coiled up in a branch into which we had backed. Scorpions and centipedes, wasps and hornets, which nest in the earth, every kind of stinging and evil-smelling abomination, crawled over or fluttered among the trees in which they had sought shelter. We killed two large, black, crab-like scorpions in the boat. I was myself stung by a centipede which fastened on to the back of my neck, and our skins were raw with the stinging and biting of ants and other lesser insects. All that day we pushed on through the submerged forest, baling out water and wild beasts at intervals."

Indian Village Folk: their Works and Ways. By J. R. Pandian. London: Elliot Stock, 1898. Pp. 212.

This little volume is the work of a native Christian of the south of India, and comes to us recommended by the venerable Archdeacon Sinclair. It contains a series of sketches of the people of Southern India, which, as the writer is one of themselves, may be considered accurate, although they are not flattering. For those who care to know, in a superficial way, the occupations and customs of the principal members of an Indian community, the book will be interesting and useful. The writer tells one story which reminds us of the adventures of the famous Baron Münchhausen. It runs thus: "We have seen a hunter wrestle with a tiger which he was hunting. The half of the left hand of the man was in the mouth of the tiger, and the right leg of the beast was round the back of the man, while the man with his right hand was lifting the upper jaw of the tiger. The tiger tried his best to extricate his upper jaw from the hand of the man, but the man held on *for about an hour*, when another hunter came with his gun and shot the beast."

Cannosa. Prag: Heinr Mercy, 1897. Pp. 36.

For this volume we are again indebted to an illustrious traveller who prefers to remain anonymous. It is on the same splendid scale as previous volumes from the same source, and is, like them, illustrated by sketches by the author, finely engraved by F. Havranek. Cannosa is a delightful locality in Southern Dalmatia, situated between Sabbioncello and Ragusa, and it is, in the author's opinion, the most charming place he knows, on the Adriatic's eastern coast, for a summer holiday. This is a very high recommendation, for, scientifically and artistically, no one knows this coast better than the author. The quickest way of reaching this paradise is by the daily steamer from Gravosa, but there is also a road to it from

there (two hours) during which "a series of magnificent views, each lovelier than the other, opens before the wondering gaze of the traveller; first the valley of Ombla, then a splendid coast-line, then the exquisite Gulf of Malfi, then a view of the pine-clad peninsula of Lapad, and the foam-girt Pettini."

Limnologia des Plattensees. Von Eugen v. Cholnoky. Wien: Commissionsverlag von Ed. Hölzel, 1897. Pp. 118.

The Plattensee, or Lake Balaton, is the largest lake in Hungary, being some forty-four miles in length. The Hungarian Geographical Society has therefore undertaken a thorough examination of the lake, and is publishing the results in three volumes, dealing respectively with its physical geography, biology, and social and anthropological geography. The above section of the first volume treats of the changes of level in the waters of the lake, periodical and irregular, and with the winds, changes of atmospheric pressure, etc., which control these variations. There is also a chapter on the currents in the Tihany narrows.

Herr von Cholnoky describes the limnograph used, and illustrates the results by numerous tables and diagrams. It would be impossible here to give a sketch of the complicated movements of the surface, the theory of which can only be clearly demonstrated by numerous data, and with the aid of mathematical formulæ. The work is of importance, not only as regards the Plattensee, but as a study of the movements of enclosed waters in general, and the forces that produce them.

The Story of South Africa. (Story of the Empire Series.) By W. Basil Worsfold. London: Horace Marshall and Son, n.d. Pp. 175. *Price* 1s. 6d.

This little volume contains a graphic and spirited sketch of the history of the colonisation of South Africa by the Dutch and the British. There is no attempt on the part of the writer to conceal his anti-Dutch proclivities, and next to the Dutch he places the home government as the principal difficulty in the development of the colony. The reader who is prepared to accept two theories as correct, viz., that the Boers are something like two centuries behind the British in civilisation, and that the home government has persistently neglected, or even sacrificed, the interests of the colony, will find in Mr. Worsfold a pertinacious and not unskilful exponent of his views. But, as every one knows, these two theories cannot be accepted without considerable modifications, and in the affairs of South Africa, as elsewhere, there are two sides to every question. The story, however, as told from the writer's one-sided point of view, is crisp and interesting.

The Meteorology of Edinburgh. By Robert Cockburn Mossman, F.R.S.E., F.R. Met. Soc. (*Transactions of the Royal Society of Edinburgh*, vol. xxxviii. part 3, and vol. xxxix. part 1.)

In the first of these volumes Mr. Mossman shows in tabular form the mean values of the climatic elements for each day in the year, the data being calculated, as far as possible, for the fifty years, 1840-51 and 1857-94. The second part contains tables drawn up from various meteorological registers kept in Edinburgh during the past century and a half and more. Perhaps few, except those who have done similar work, can realise the immense toil and carefulness that such a compilation must have entailed. Especially is this the case with the reduction and correction of the incomplete and loosely kept records of earlier times, where interpolation and differentiation must be largely resorted to. Personal observations

(non-instrumental) on thunderstorms, days with hail, mist, or frost, etc., are also included.

Meteorologists requiring data on the past meteorology of Edinburgh will find all they want in this work, which will no doubt become the standard book of reference on the subject.

A Geography of Europe. By Lionel W. Lyde, M.A., F.R.S.G.S. Examiner in Geography to the College of Preceptors; Headmaster of the English Department in Glasgow Academy, etc. London: Adam and Charles Black, 1897. Pp. vi + 120. *Price* 1*s*.

This is a capital little school-book dealing with the geography of Europe exclusive of the British Isles, more especially in its economic aspects. The book bears witness that its author is a man of much practical experience in the teaching of geography. Only the more important facts are given; these are stated with admirable clearness, and, throughout, the causal connection between the natural features of the country and their economic consequences is insisted upon. A treatment of this kind, by appealing to the student's reasoning power, cannot help to be both interesting and stimulating, and we anticipate a great success for the book. It seems particularly well adapted for preparing for examinations, but, let us hope, that neither master nor pupil will think that nothing beyond what is contained in Mr. Lyde's book is worth studying regarding the geography of European countries. We noticed a few slips: Bonn is not, as stated on p. 69, the centre of the Saar district, and the important Austrian town mentioned on pp. 77 and 80 is not Grätz but Graz.

Leitfaden der Geographie für höhere Lehranstalten. Von Prof. Dr. R. Langenbeck. Zweiter Teil. Lehrstoff der mittleren und oberen Klassen. Zweite umgearbeitete Auflage. Leipzig: Verlag von Wilhelm Engelmann, 1897. Pp. 321 + vi.

The first edition of the *Leitfaden* was noticed in this Magazine (vol. xi. p. 326). The book met with a favourable reception in Germany, and was introduced into several schools. In the new edition the method and arrangement are on the whole the same as in the first, but the author has abridged nearly every chapter and brought the information up to date. A very useful and necessary addition is the chapter on the principal land and sea routes. Of more questionable value is the indication of the pronunciation of foreign names; we would advise the author to revise this very carefully in a future edition, as the pronunciation given is entirely wrong in a great many cases.

Deutsches Meteorologisches Jahrbuch für 1896. *Freie Hansestadt Bremen. Ergebnisse der Meteorologischen Beobachtungen in Jahre* 1896. Herausgegeben von Dr. Paul Bergholz. Bremen: Max Nössler's Buchdruckerei, 1897.

The observations for the year at Bremen are here given with unusual care and completeness. The records of atmospheric pressure, wind, temperature, humidity, precipitation, and sunshine are recorded for every hour of the day, and to each table is appended the height of the instrument above the ground, the correction for gravity in the case of pressure, extremes, etc. Other tables show the monthly means of pressure and temperature, the daily variation, etc., etc. The daily variation of pressure in monthly, seasonal, and yearly means are given for the years 1891-95, and in the next number will be graphically represented. The publication exhibits the meteorological phenomena of the year with a fulness of detail that leaves nothing to be desired.

NEW MAPS.

AFRICA.

AFRICA, Bartholomew's Political Map of ——, according to most recent treaties. By J. G. Bartholomew, F.R.G.S., 1898. Scale 1 : 12,000,000. *Price* 3*s. cloth.* *John Bartholomew and Co., Edinburgh.*

There are not very many changes in the political boundaries of Africa since the last edition of this map. Abyssinia is no longer under the protection of Italy, and the boundary of British Somaliland has been modified. In the west the northern limits of Togoland have been defined. All these changes, and one or two others of less importance, are marked on the new map, which also differs from its predecessors in showing surface features. The colouring also is more agreeable to the eye, and the insets are improved, notably Cairo and its environs.

ATLAS.

The Observer's Atlas of the Heavens. By William Peck, F.R.A.S., F.R.S.E. London : Gall and Inglis, 1898. 38 pp. letterpress. 40 Plates. Folio. *Price* 21*s.*

This new atlas is a good one for the amateur astronomer, and indeed for all who take an intelligent interest in the ordinary facts of astronomy.

The Edinburgh City Astronomer has succeeded in grouping together in a handy form all the facts that the possessor of a telescope desires to have to enable him to observe the astronomical phenomena within his grasp. Mr. Peck has taken full advantage of recent progress in accurately mapping the heavens and in accurately measuring the light of the stars by modern stellar photometers. For the amateur astronomer there are useful tables of test objects for telescopes, catalogues of the radiant points of the principal meteor systems, of over 1000 double stars, of nebulæ and star-clusters, of variable and of coloured stars, and of the brighter stars gauged to one-tenth of a magnitude. Even a beginner will realise how useful these tables are to an observer. The heavens are mapped out in a series of thirty large scale sheets, of which the "constellation" is the unit, each constellation (with slight exceptions) being shown entire on the section which depicts it. Although this seems to involve much needless repetition, yet with the index it is found to be of distinct advantage to the amateur, to whom, as a rule, the configuration of a constellation is the modulus of recognition. We regret, however, the absence on the maps of the proper names of the principal stars. They are to be found in the index, but we trust that Mr. Peck will, in a new edition, add these names to the constellation charts. We would also suggest that the diagrammatic conventional figures showing magnitudes, etc., given at the foot of p. 31, should be repeated on the margin of each of the sectional maps.

A chart of the Zodiacal and Equatorial region of the heavens, with the paths of the principal planets, will be found useful to many, and there is a good map, eleven inches diameter, showing the physical features of the moon. Another useful feature for the observer is the series of diagrams showing the telescopic appearance of 1020 double stars. The maps are well printed, and distinctly indicate the positions, magnitudes, and distinguishing letter numbers of the members of the constellations.

Altogether this atlas is a most useful popular compendium in handy form.

148
180
170
160
150
140
130
Franklin
C. North
Herald I
C. Hawaii
Icy Cape
C. Barrow
Smith B.
Harrison B
Franklin B.
C. Bathurst
Mackenzie
Camden B.
Inland R.
Colville R.
Kotz. R.
Point Hope
Escamaux
East C.
Diomede Is.
Bering Strait
Kotzebue Sd.
Cape Pr. of Wales
Fort Yukon
Porcupine R.
Fort Reliance
Yukon R.
Circle
Belle I.
Tanana R.
Dawson
Ogilvie
ALASKA
Norton Sound
St. Michael
Fort Selkirk
Pelly R.
Romanzof
Koyukuk R.
Mt. Wrangel
Lawrence I
Kowak R.

ARCTIC OCEAN
ALASKA
SKETCH MAP
ALASKA
showing Yukon Route
MACKENZIE
YUKON
ATHABASCA
BRITISH
COLUMBIA
ALBERTA
PACIFIC
OCEAN
MAP OF
WESTERN PART
OF THE
DOMINION OF CANADA
TO ACCOMPANY A PAPER BY WM OGILVIE
DOMINION OF CANADA
Railways open
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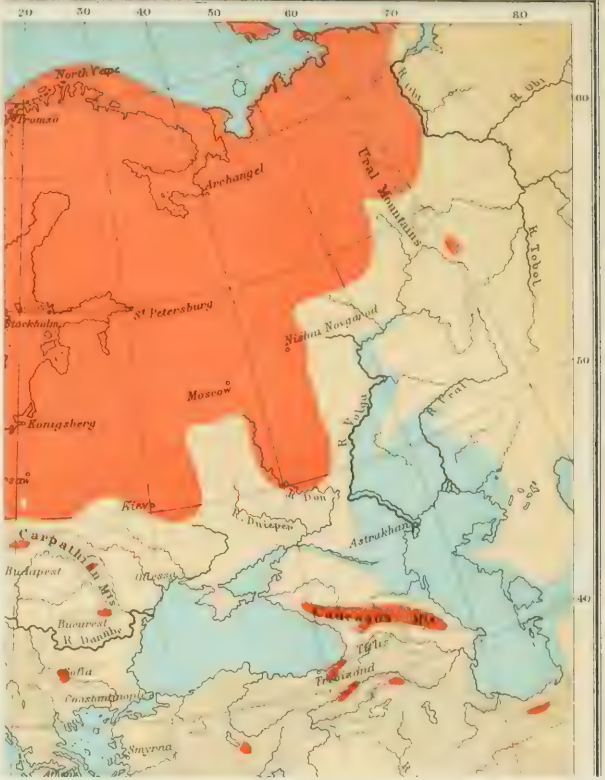
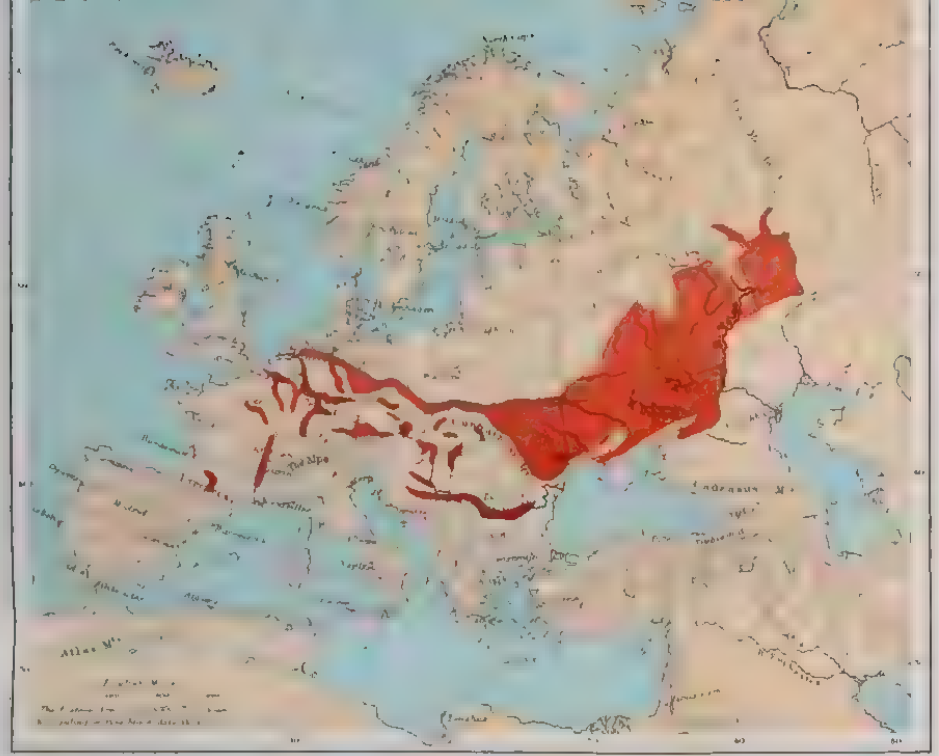
TABLE LAND
INLAND

OF EUROPE (Second Glacial Epoch). B





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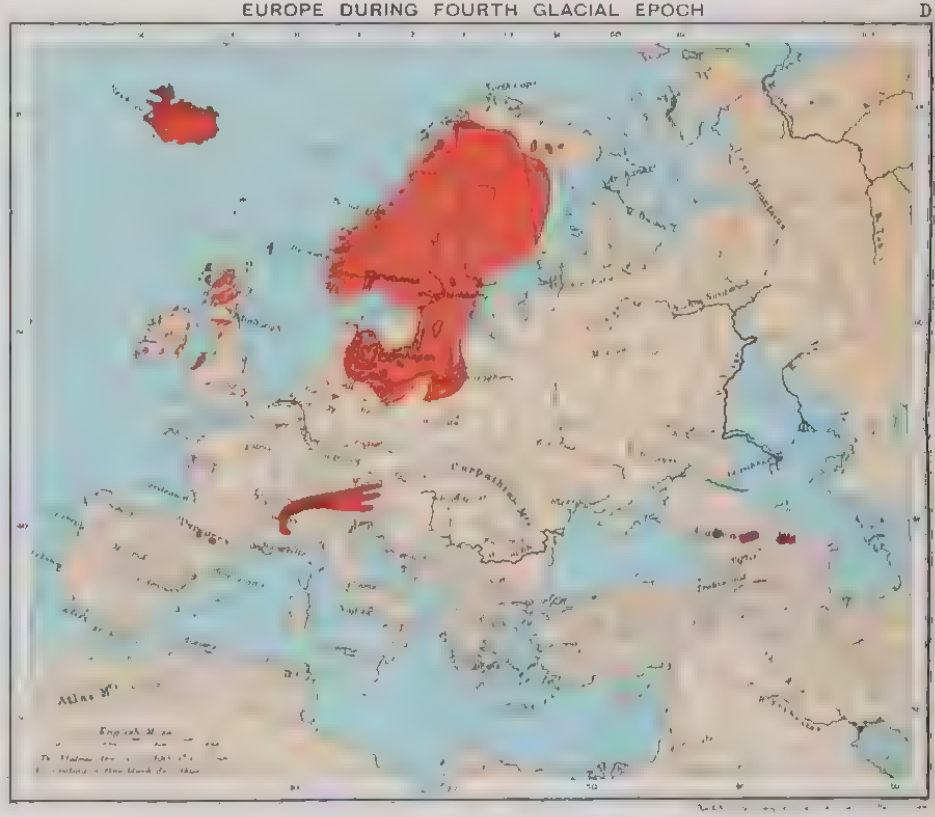

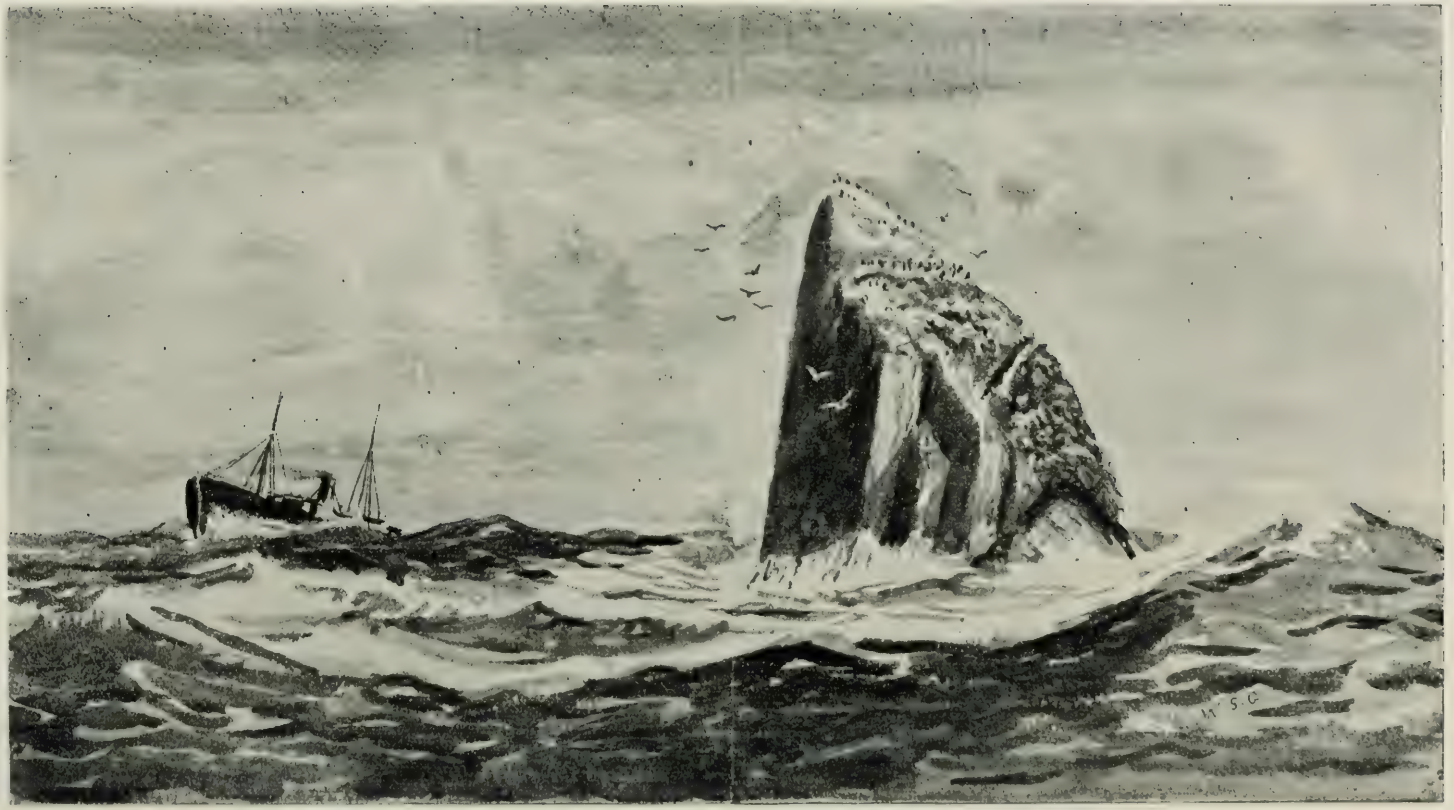

ROCKALL.

(*Viewed from the N.E.; from a Drawing by the Rev. W. Spotswood Green*, 1896.)

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ROCKALL.

By Miller Christy, F.L.S.

I. Introductory Remarks.

To the average person, the existence of the locality known as Rockall is almost, or wholly, unknown. It might form part of the British Isles, or be situated in Central Asia, so far as the ordinary man is able to tell. Even among those who pay special regard to the study of geography, comparatively few could at once, and off-hand, state its position, nature, and points of interest, if asked to do so. Many gazetteers and geography books, even of the better class, wholly ignore its existence. Yet Rockall is as remarkable as any locality of its kind in the whole world. It is, indeed, in some respects, unique; while its nature, its position, and its surroundings are of quite a romantic kind; its interest, from a scientific point of view, is considerable; and, as the most westerly outpost of the British Isles, it deserves something more than the very meagre share of attention it has hitherto received.

I have for some years taken a deep interest in this strange and (from some points of view) fascinating locality, and have collected all the information relating to it that I have been able to lay hands upon. The result may be seen in the following remarks, which are intended as a convenient summary of all that is known to date concerning Rockall, and as a guide which shall indicate to any who may be fortunate enough to visit it in future the chief points in connection with it which require further investigation.

The literature relating to Rockall is widely scattered throughout miscellaneous narratives of travel, the publications of learned societies, nautical magazines, and country newspapers; but the contributions of all writers of importance are cited in the following article.

It will be convenient to summarise the information to be given under the following additional sub-headings :—

II. Its Nature, Position, etc.
III. Its History.
IV. Its Points of Scientific Interest; and
V. Concluding Remarks.

II. Its Nature, Position, etc.

Rockall is a lonely and isolated rock, of conical or pyramidal shape, rising sheer out of the stormy waters of the Atlantic, to the north-west of the British Isles. Speaking in general terms, its position is about 160 geographical miles west-half-south from St. Kilda in the Outer Hebrides; about 290 miles almost due west from Ru Ruag, on the coast of Ross-shire (the nearest point of the Scottish mainland, with the exception of Ardnamurchan Point, much farther south, which is a few miles nearer); about 260 miles north-west from the Bloody Foreland (the nearest point on the mainland of Ireland, though Erris Head, farther south in the County Mayo, is only a few miles more distant); and about 470 miles south-east-by-south from the nearest part of Iceland. Its exact position, as laid down by the latest *Admiralty Sailing Directions* (1896, p. 739), is lat. 57° 36′ N., long. 13° 42′ W. The rock at its base has a circumference of about 250 feet, and its summit (which is more or less pointed, and is always whitened by the dung of sea-birds) rises to a height of about 70 feet above the surface of the water. Its western face is absolutely perpendicular, and all its other sides are almost precipitous, the north-east face being the least steep. Around its base (which has a circumference of about 100 yards) are several ledges, over which the waves usually dash furiously. Several writers familiar with the rock have spoken of it as resembling, in shape and appearance, a large haycock floating on the surface of the sea. The rock is said to be composed (mainly, at least) of a coarse dark-coloured granite, and to be highly magnetic—statements which will be considered hereafter. There is neither soil upon it nor sandy beach around it, the depth of water close up to it being from twenty to thirty fathoms. It cannot, therefore, strictly be spoken of otherwise than as a "rock"—not as an "island," nor even as an "islet." Owing to the steepness of its sides, and to the prevalence of the Atlantic swell, which surges almost incessantly round it, a landing upon the rock can only be effected in the very finest and calmest weather—perhaps on not more than two or three days in the course of a summer. There can be no doubt that in winter the waves often dash over its summit. The captains of vessels passing the rock at a distance, or when first sighting it—even those familiar with it—almost invariably take it at first for a vessel in full sail, owing to its height, its steep sides, and its whitened summit.

About a cable and a half north-east-by-north from the main rock is a small reef, exposed at half-tide, and known as Haselwood rock. The water between them has a depth of thirty fathoms.

Another similar rock, known as the Helen's reef (from the fact that

the wreck upon it of a vessel of that name first made its existence known, as mentioned hereafter), lies about one mile and three-quarters east-by-south from the main rock. Its top, though usually submerged, is said to have been seen in the trough of the sea at low water springs. Usually its position is shown by breakers; but at high water (the rise being about six feet), and in fine weather, it causes the sea to break only at long intervals. Inasmuch as it is of small size, is usually submerged, and is steep-to (that is to say, the water is deep right alongside it), it is (as may be imagined) extremely dangerous to passing vessels, especially to those whose commanders do not know of its existence.

Several observers have recorded the existence, around the base of the rock, of other reefs, upon which in bad weather the sea breaks heavily; but these are not shown on the charts, and their existence is doubtful.

Captain Basil Hall is responsible for the description of Rockall as the most diminutive speck of dry land, in the shape of island, islet, or rock rising out of the sea, to be found anywhere in the world at so great a distance from any mainland. "The smallest point of a pencil," he says,[1] "could scarcely give it a place on any map which should not exaggerate its proportions to the rest of the islands in that stormy ocean." This description, published nearly seventy years ago, appears to be literally correct. The nearest approach to Rockall in this respect is probably afforded by the St. Paul's Rocks, which lie in the Atlantic almost on the equator, and midway between Africa and South America;[2] but these rocks, though farther from any mainland, are much larger than Rockall.

Nevertheless, isolated and remote as Rockall is, it marks the highest point of an extensive "bank" or submarine plateau, a large part of which would be exposed as dry land were the sea-bottom elevated no more than one hundred fathoms, and which, in all probability, has been actually thus exposed within (geologically speaking) comparatively recent times.[3] "Rockall bank" (as it is called) extends from north-west to south-east, that portion lying within the 200-fathom contour-line being about 150 miles long and 50 miles broad. About half of this area lies within a 100-fathom contour-line (Rockall itself lying rather to the north-east of the centre). Within a radius of two miles and a half from the rock, the depths range from forty to seventy fathoms.

Although Rockall forms (as has been said) part of the British Islands, this must be understood in a political, rather than in a physiographical, sense. The rock is, of course, far nearer to these islands than to any other land; but between the two lies a deep sea giving soundings from 1000 up to 1600 fathoms—depths which can only be regarded as

[1] *Fragments of Voyages and Travels* (London, 3 vols., post 8vo), vol. iii., p. 179. There are several later editions.

[2] The St. Paul's Rocks (which must not be confounded with St. Paul's Island, in the Indian Ocean) lie about one degree north of the Equator, in long. 29° 15′ W., and about 540 miles from the coast of Brazil. They are of irregular outline, and appear from a distance like one island, though in reality separated from one another by deep narrow channels. They occupy together an area measuring about 470 yards by 230 yards. The rock of which they are composed is probably eruptive.

[3] See *post*, p. 411.

truly oceanic, and which indicate that the period when a dry-land communication existed between Rockall and the British Isles (if, indeed, it ever did so) must have been immensely remote, even as the geologist reckons time. The significance of this fact becomes more obvious when it is remembered that all the other islands adjacent to Britain, with the single exception of the Færo group, lie well within the 100-fathom contour-line surrounding these islands, even including St. Kilda, which, though as much as 130 miles from any portion of the mainland of Britain, is the nearest point of land to Rockall. That is to say, that, to enable a man to wade out through the sea to Rockall, he would need to have legs *sixteen* times as long as to reach any other island adjacent to Britain, except Færo. This remarkable oceanic abyss which exists between Rockall and Britain is a spur or projection of the still deeper area lying in the middle of the Atlantic, which runs up from the south-west. It is true that, farther north, Rockall and the north of Scotland are connected by an area of shallower water, which includes also the Færoes; but even there the depths are considerable, approaching 1000 fathoms. Rockall and its bank are, therefore, excluded from the "British Atlantic Slope District," as defined by the British Association's Committee on British Marine Zoological Areas. That "District" is described[1] as lying to the west and north of Britain, between the 100-fathom contour-line and the 1000-fathom line, at which depth the "abysmal floor of the ocean" is said to commence. Indeed, as the depths between Rockall and Iceland are comparatively small—only 500 or 600 fathoms—and as Iceland belongs, physiographically, rather to the American than the European area, it may even be said that, from this point of view, Rockall forms the easternmost outlier of North America, rather than the westernmost outlier of Europe, in spite of its much greater nearness to the latter.

There seems good reason for believing (from evidence afforded by certain old charts to be mentioned hereafter) that, as lately as the beginning or middle of the seventeenth century, Haselwood rock, Helen's reef, and a sandbank of small extent surrounding the main rock, were exposed as dry land—at any rate, during low water; but this point may be more fitly discussed in Section IV.

Of modern charts showing Rockall and its bank, the best obtainable is Messrs. Imray's *Chart of the Seas North-west of the British Isles*.[2] The excellent English Admiralty Chart of the locality, published in 1861,[3] is now out of print and no longer obtainable. Rockall is, however, of course, shown, though in less detail, on various Admiralty charts of the North Atlantic Ocean. Among the best of them is the chart of *The Banks and Soundings to the Westward of the British Isles, surveyed by Captain A. E. T. Vidal, 1830 and 1831* (published September 13, 1833). The two accompanying charts show, according to the latest information, the outline of Rockall Bank and the general position of Rockall in reference

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[1] *Report of Manchester Meeting, 1887*, p. 95.

[2] London (James Imray and Son), corrected to 1898.

[3] *North Atlantic: Rockall and Soundings in its Vicinity, 1831* (No. 2870). Published 25th Nov. 1861 and corrected to Dec. 1863.

to the nearest British and Irish coasts, with the remarkable depths between those coasts and it.

A roughly-executed woodcut view of the rock (probably the first ever published) appeared in 1812 in Purdy's *Memoir of a Chart of the Atlantic*.[1] The drawing from which it was prepared was obtained when the rock was visited by Captain Basil Hall on July 8th, 1810, as mentioned hereafter. The same drawing doubtless also served for the more pleasing copper-plate vignette which appeared in 1831 on the title-page of the third volume of Hall's *Fragments of Voyages and Travel*. Other views (probably derived from the same source) appeared on the margin of the general chart of the British islands in several of the earlier editions of Stieler's *Hand-Atlas* (Gotha), and in Messrs. Harvie-Brown and Buckley's *Vertebrate Fauna of the Outer Hebrides*.[2] On the Admiralty chart of Rockall alluded to above, no fewer than eight excellent views of the rock, taken from as many different points, are given. All the above-mentioned representations of the rock have, however, now been superseded by the recent publication[3] of nine views of it, reproduced directly from photographs taken from different points during an expedition made to the rock in 1896, as mentioned hereafter. These are accompanied by three large coloured lithographed views of the rock, most effectively reproduced from drawings made on the same occasion by the Rev. W. Spotswood Green. I am indebted to the same gentleman for the kind loan of the drawing from which has been reproduced the very excellent representation of the rock which faces page 393 ; for the photographic views of the rock reproduced (for the first time) on the plate facing page 404 ; and for the sketch-plan of the rock appearing on page 408. The sketches were made, and the photographs taken, by the reverend gentleman, assisted by his son, Mr. C. Green, during the recent expedition in which he took part. No attempt has, I believe, ever before been made to represent the ground-plan of the rock.

Allusion has already been made to the resemblance between the rock, when seen from a distance, and a ship in full sail. This resemblance is so close as to deceive all but those navigators who know of, and are actually on the look-out for, the rock. On this point, Captain Basil Hall, R.N., says:[4]—

". . . the top being covered with a coating as white as snow, from having been for ages the resting-place of myriads of sea-fowl, it is constantly mistaken for a vessel under all sail. We were deceived by it several times during the same cruise [in H.M.S. *Endymion*], even after we had been put on our guard and knew its place well. I remember boarding three ships in one day, each of which, in reckoning the number of vessels in sight, had counted Rockall as one, without detecting their mistake till I pointed their glasses to the spot."

The same writer elsewhere[5] recounts the circumstances of one of the cases in which he himself was misled :—

[1] London, demy 8vo, p. 219.
[2] Edinburgh, 4to, 1888, plate facing p. lxxxvii.
[3] *Trans. Roy. Irish Acad.*, vol. xxxi. (1897), part 3.
[4] *Fragments of Voyages and Travel* (1831), vol. iii., p. 180. [5] *Op. cit.*, vol. iii., p. 178

"In a fine autumnal morning, . . . a sail was reported on the lee-beam. We bore up instantly, but no one could make out what the chase was, nor which way she was standing—at least, no two of the knowing ones could be found to agree upon these matters. . . . The general opinion was that it must be a brig with very white sails aloft, while those below were quite dark—as if the royals were made of cotton and the courses of tarpaulin—a strange anomaly in seamanship, it is true, but still the best theory we could form to explain the appearances. A short time served to dispel these fancies; for we discovered, on running close to our mysterious vessel, that we had been actually chasing a rock—not a ship of oak and iron, but a solid block of granite, growing, as it were, out of the sea. . . ."

Since Hall wrote thus, nearly every seaman who has described his sighting of Rockall has alluded to its extraordinary resemblance to a ship in full sail. It will suffice to quote the remarks of two such writers.

Surgeon Alexander Fisher, R.N., writing on May 24th, 1819, says:[1]—

"We had a distant view to-day of that remarkable insulated rock called Rockal. It looked, at the distance we were from it (viz., between four and five leagues), exactly like a ship under sail: it was reported, indeed, by the first person who saw it, to be a strange vessel. Its resemblance, not only in form, but also its colour, tended to make the deception more complete; for it appeared to be perfectly white, a hue most probably produced by the excrement of birds. Our distance from it, indeed, was too great to enable us to speak with certainty on this head; but, from the number of birds we saw in its neighbourhood, and its insular situation, we may fairly conclude that it is well inhabited by the feathered race, for here they are perfectly secure from the attacks of their greatest enemy—man."

Captain Andresen, a Færoese smack-owner, says[2] that, amongst a number of boats with sails set, it is "almost impossible to distinguish the rock from the boats [when] at a distance."

Allusion has already been made to the dangerous nature of the two reefs lying near Rockall, especially Helen's reef, which lies a mile and three-quarters from the main rock. These reefs have never been either lighted, belled, or buoyed. Inquiry at the Trinity House has elicited the information that Rockall has never been deemed to lie within the jurisdiction of the General Lighting Authorities Yet there can be no doubt that the rock and the adjacent reefs, though not in the most direct and most frequented line of cross-Atlantic traffic, have, in the past, not only imperilled many vessels, but have actually caused the loss of some. The wreck of a French or Spanish ship at Rockall in 1686 will be alluded to hereafter; while the loss, in 1824, of the Dundee brigantine *Helen* and sixteen lives, has already been mentioned. The latest *Admiralty Sailing Directions* describe the reefs as "very dangerous," and fishing captains who have fished upon the bank have strongly indorsed this statement. Captain Thomas Blanche, of Burravoe, Shetland, who has had much experience of fishing on the bank, says:[3]—

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[1] *Journal of a Voyage of Discovery into the Arctic Regions, in His Majesty's Ships "Hekla" and "Griper," in the years 1819 and 1820*, 4th ed. (London, demy 8vo, 1821), p. 14.

[2] See *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895), p. 71.

[3] See Harvie-Brown and Buckley's *Vertebrate Fauna of the Outer Hebrides*, pp. 89-90.

"While there [in 1869], vessels were daily passing. My opinion is that many a vessel is cast away on that rock. One day, a vessel under full stu'nsails was heading east or north-east, appearing to keep clear of the rock, but not of the reef. When she was two miles off the reef, the sea broke over it. She then hauled to the west and stood clear of the reef. They either did not know about the reef or did not know it was so far off the rock. Had this affair occurred in the night-time, or in thick weather, probably they would have been lost."

On this question, no one can speak with greater authority than Captain William Barron, of the Trinity House at Hull, who, in his younger days, when engaged in the Davis Strait whale-fishery, passed the rock on many occasions. He says:[1]—

"If the truth was known, I daresay that many a stout vessel has been lost upon the rock and reef adjacent, and not a vestige or a soul left to tell the tale. It is so situated that vessels, in former days, bound east from America and driven by a continuance of southerly winds, have frequently seen it in the day-time, but there is nothing to denote its situation by night. Thus it was a source of great anxiety for masters of sailing ships in those days. . . . Such places near our coast are so little known; yet rocks, shoals, and small islands, thousands of miles away and seldom seen, are accurately marked on the charts and known to navigators; but this small spot, so near to us, has been the dread of mariners for many years back in misty weather. At the same time, it is almost an impossibility to erect a lighthouse to warn seamen of its proximity. A landing cannot be obtained, perhaps, not more than once in twelve months, on account of the ever-rolling swell of the Atlantic."

A Captain Osborn, of Workington, has stated[2] that "on his passage from Quebec, in 1806, it was with the utmost difficulty he escaped getting amongst the breakers" round Helen's reef.

On the whole, it seems not improbable that some, at least, of the mysterious disappearances of well-found vessels which are reported annually from the Atlantic are connected with these dangerous hidden reefs.

III. Its History.[3]

It is highly remarkable, considering the large number of fabulous, or "phantom," islands with which tradition half filled the North Atlantic between the fifteenth and the seventeenth centuries, that Rockall, the only *real* island at all corresponding in general position to these fabulous islands, should not be shown with any certainty upon the marine charts before the beginning of the seventeenth century; yet such appears to be the case. Although I may claim a more than ordinary familiarity with the cartography of the North Atlantic from the very earliest times, I am quite unable to point with confidence to a representation of Rockall on any chart earlier than the year 1600. Nevertheless,

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[1] *Old Whaling Days* (Hull, crown 8vo, 1895), p. 179.

[2] See Purdy's *Memoir of a Chart of the Atlantic*, 5th ed. (1825), p. 242.

[3] In preparing this section, much assistance has been obtained from information collected by Prof. T. Rupert Jones, F.R.S. (*See Trans. Roy. Irish Acad.*, vol. xiii., pp. 89-97.)

there are earlier charts upon which islands are shown, one of which *may* be intended to represent it. Thus, nearly all the earliest charts—those of the thirteenth and fourteenth centuries—showing the eastern portion of the North Atlantic, show, to the north and north-west of Britain, a number of islands (mostly nameless, of a conventional character, and incapable of identification), one of which *may* have had its origin in Rockall. This is the more probable inasmuch as the existence of the rock cannot have been unknown to the Bristol merchants who, from very early times, carried on a trade in dried fish with Iceland. Again, on the celebrated globe of Martin Behaim, made in 1492 at Nuremberg, and still preserved there, a nameless island is represented near where Rockall actually lies. On the map of the British Isles in the Latin *Ptolemy* of 1525 (Strassburg) an island called "Danchuli" is represented in lat. 57° N.,[1] and (as far as can be estimated) in about long. 10° W. from Greenwich. This, considering the means of calculating latitude and longitude at the time, might be thought to represent Rockall; but it seems certain that, in this case, the island now called St. Kilda is intended. On a Portuguese chart of about the year 1550, preserved in the Bibliothèque Nationale, Paris,[2] there appears, just to the north of Ireland, a fair-sized island, against which there is a name apparently similar to "Rochol," but the ink was unfortunately smeared by the draughtsman before it was dry. Otherwise, I have not been able to discover any indication of Rockall upon any chart earlier than the year 1600.

Immediately after the commencement of the seventeenth century, however, Rockall commenced to appear under the names of "Rocol," "Rochol," or "Rokol," upon most (though not all) good charts showing the North Atlantic. The very earliest representation of it I have observed is on the map by Gulielmus Jansonius (Blaeu), entitled *Nova Totius Terrarum Orbis Geographica ac Hydrographica Tabula*, and published in 1606,[3] whereon it appears as "Rocol" in lat. 57° 30′ and about long. 11° 20′ W. from Greenwich.

In 1618, it appeared as "Rochol" on the chart of the Atlantic drawn on parchment at Lisbon by Domingo Sanches, and now preserved in the Bibliothèque Nationale in Paris.[4]

In 1636, it appeared as "Rokol" on the maps of the World and of the North Polar Regions, in Hexham's edition of Mercator's *Atlas* (Amsterdam, 2 parts, 1636-38).

About the same time, it was represented, with a smaller rock a little to the north-east of it, on a globe now preserved in the Bibliothèque Nationale in Paris.[5]

In 1650, it was shown as "Rocol" in Janson's *Atlas* (Amsterdam).

On Johannes van Keulen's *Kaart van de Noord* [*Atlantic*] *Oceaen*

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[1] On the chart, the lat. is shown as 55°, but all the latitudes are placed about 2° too low.

[2] *Cartes*, Inv. 1021.

[3] The only copy I have seen is in the British Museum (*Maps* 920 (262).)

[4] *Cartes*, C. 19,251.

[5] *Cartes*, Inv. 5.

(Amsterdam, 1692), it appears as "Rocol," with a smaller rock on each side of it.

In 1693, it appeared as quite a large island, with a small rock on each side of it, on a map in *Le Neptune François* (Paris).

Of its appearance on charts of the eighteenth and nineteenth centuries, it is needless to speak here.

The earliest written reference to Rockall with which I am acquainted is a statement by Martin Martin, published in 1698,[1] to the effect that, in 1686, a company of Frenchmen and Spaniards lost their ship at "Rockol" and escaped in their boat to St. Kilda, the inhabitants of which island (adds Martin) then called it "Rokabarra."

Although the existence of Rockall was perfectly well known during the eighteenth century, little or no interest appears to have been taken in it, and I am unable to refer to any statements that it was ever landed upon by any one at this period. The only description of it I am able to cite as belonging to this century is the following by Captain W. Coats, who, as a captain in the service of the Hudson's Bay Company, passed the rock on many occasions during his voyages between England and the entrance to Hudson's Strait between the years 1727 and 1751. He says:[2]—

"Rokel is a solitary island in latitude 57° 38′ N.; longitude west from Hoy Head, 10° 30′ W. Rokele is a pyramid not unlike the Stack, but higher and bigger, and white from the same cause; and I had no ground at eighty fathom on the NW. side at a distance of a mile and a half; and I made east 10° N.-erly from this rock to Hoy heade."

Since the beginning of the present century, more attention has been devoted to the rock, which has been frequently visited and several times landed upon. The earliest landing effected was (so far as I can ascertain) on July 8th, 1810, when the master (Mr. T. Harvey) and some of the officers of His Majesty's frigate *Endymion* (then commanded by the Hon. Thomas Bladen Capel), with two boats' crews, effected a landing, of which Captain Basil Hall, R.N., F.R.S. (then lieutenant), who took part, has given an excellent and well-known account. He says:[3]—

"As we had nothing better on our hands, it was resolved to make an exploring expedition to visit this little islet. Two boats were accordingly manned for the purpose; and, while the ship stood down to leeward of it, the artists prepared their sketch-books and the geologists their hammers for a grand scientific field-day.

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[1] *A Late Voyage to St. Kilda* (London, 8vo), p. 15.

[2] *The Geography of Hudson's Bay*, by Capt. W. Coats, edited by John Barrow (London, Hakluyt Society, demy 8vo, 1852), p. 7.

[3] *Fragments of Voyages and Travels*, vol. iii., p. 180. The date mentioned above is that given (*Memoir of a Chart of the Atlantic*, London, 8vo, 1812, p. 219) by John Purdy, to whom the scientific results of the landing appear to have been communicated. From Hall's own narrative, one would infer that the landing was effected about the middle of September 1811; but, as he wrote twenty years later, he may well have been in error as to the date. The position of the rock, as ascertained (for the first time) on this occasion, was lat. 57° 39′ 32″ N., long. 13° 31′ 16″ W. (mean), which was erroneous by about 3′ as regards latitude, and 11′ as regards longitude.

"When we left the ship, the sea appeared so unusually smooth that we anticipated no difficulty in landing; but, on reaching the spot, we found a swell rising and falling many feet, which made it an exceedingly troublesome matter to accomplish our purpose. One side of the rock was perpendicular, and as smooth as a wall. The others, though steep and slippery, were sufficiently varied in their surface to admit of our crawling up when once out of the boat. . . . In time, however, we all got up, hammers, sketch-books, and chronometers inclusive.

"As it was considered a point of some moment to determine not only the position, but the size of the rock by actual observations made upon it, all hands were set busily to work—some to chip off specimens, others to measure the girth by means of a cord; while one of the boats was sent to make soundings in those directions where the bottom could be reached.

" . . . I forget exactly at what hour a slight trace of haze first came across the field of view. This soon thickened into a fog, which felt like a drizzle, and put some awkward apprehensions into our heads. It was immediately decided to get into the boats and return to the *Endymion*, for by this time we had finished all our real work, and were only amusing ourselves by scrambling about the rock.

"The swell had silently increased in the interval to such a height that the operation of returning to the boats was rendered twice as difficult as that of disembarking, and, what was a great deal worse, occupied twice as much time. It required the greater part of half an hour to tumble our whole party back again. This proceeding, difficult at any season I should suppose, was now reduced to a sort of somerset or flying leap; for the adventurer whose turn it was to spring had to dash off the rock towards the boat, trusting more to the chance of being caught by his companions than to any skill of his own."

The return to the ship was attended by an adventure, which Captain Hall relates at some length. On pushing off from the rock it was found that the ship, though visible but a minute before, was hidden by the on-coming fog, and no one in either boat was certain of her position. After some delay, it was suggested that, from the top of the rock, the ship's masts might be visible above the fog, and a man was accordingly landed to report, but nothing was to be seen except a still thicker bank of fog, which was fast approaching and soon rendered it impossible to see ten yards in any direction. The situation was now somewhat serious; for the wind was rising, the sea was becoming rough and broken, and there was not a drop of water or a scrap of food in either boat, while (as those in the boats had recently observed) such fogs often lasted for days together. In these circumstances, it was decided to remain near the rock, as the only fixed point for which the ship could make. After anxious waiting, a slight opening of the fog allowed the "shivering scout" on the top of the rock to catch sight of the ship. Having spent a quarter of an hour in getting their lookout man on board, the boats started as fast as possible towards the ship; but they had hardly gone a quarter of a mile before both ship and rock were lost sight of in the fog, and matters became worse than ever. Fortunately, however, they were able again to recover the rock, beside which they lay, waiting for the fog once more to clear, discussing meanwhile the possibility of dragging the smaller boat to the top of the rock and there

forming a shelter. At last, just as night was falling, the fog suddenly lifted, and the ship was sighted standing away from the rock, the position of which she had lost. It was almost dark when those in the boats got safely on board her once more, after an absence of many hours. The fog had prevented them hearing the guns which had been repeatedly fired from the ship.

In October 1812, some soundings were made by H.M. ships *Leonidas* and *Brisk* in the immediate vicinity of the rock,[1] but I am unable to say whether or not a landing was effected.

On May 24th, 1819, the rock was sighted by the English Arctic Expedition to Lancaster Sound, under Parry, when outward bound. Surgeon Alexander Fisher, R.N., who accompanied the expedition, has described[2] the rock as it was seen in passing.

On April 19th, 1824, the brigantine *Helen* (Thomas Erskine, master) of Dundee, bound for Quebec and Montreal with a general cargo, struck twice on the sunken rock now called Helen's reef (which was then for the first time made known, at least to modern seamen), the weather being hazy at the time, and the captain deeming himself six miles distant from Rockall. The crew and passengers continued at the pumps for thirteen hours, but were ultimately obliged to discontinue their efforts, being overcome with fatigue, and the leak having gained upon them so much that the water had risen within three feet of the hold-beams. In launching the long-boat, she was unfortunately smashed against the vessel's side by a tremendous sea. The crew, twelve in number, with one passenger, then embarked in two other boats, apparently (according to the narrative) deserting the remaining passengers, sixteen in number (of whom seven were women and six children). Soon after the boats left the vessel, she sank, all those on board being drowned; but the crew was ultimately picked up at sea by the barque *Flora* (Captain Baker), bound from Danzig to Liverpool, and safely landed on the island of Tiree, in the Hebrides.[3]

I have not been able to discover any record to the effect that, after 1810, the rock was again landed upon before 1831, when the depth of the sea around it and off the north-west coasts of Britain was explored by Captain A. T. E. Vidal, R.N., in H.M.S. *Pike*. So far as I can discover, no account of this landing has ever been published.

In or about the year 1856, a landing upon the rock was effected by a party from Colonel Gascoigne's yacht *Myra*. One of those who landed on this occasion says:[4]—

"The yacht lay-to at some distance off the rock. The yacht party went off in boats, and landed on part of the rock which slopes down to the water's edge. After shooting a quantity of cormorants, kittywakes, and sea-gulls, they returned."

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[1] See note on Admiralty Chart, No. 2870.

[2] See *ante*, p. 398.

[3] See Purdy's *Memoir on a Chart of the Atlantic*, 5th ed. (1825), p. 241.

[4] *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895), p. 68.

In 1860, according to Wallich,[1] some further soundings were taken in the vicinity of the rock by the present Admiral Sir Leopold M'Clintock, then commanding H.M.S. *Bulldog*.

In August 1861, considerable attention was directed to the rock by the discovery (to be more fully noticed hereafter) that the shallow waters covering the bank surrounding the rock abounded in fish, especially cod. It was probably on account of this discovery that, in the following summer (1862), the rock was visited and extensive soundings taken around it by Captain R. Hoskyn in H.M.S. *Porcupine*, in the course of a cruise extending from June to August, partly undertaken in order to carry out the soundings necessary before the laying of an effective Atlantic cable. The following is an extract from Captain Hoskyn's report on the cruise:[2]—

"August 14.—At noon, observed Rockall, with several fishing vessels near it. There being too much sea to do anything in the vicinity of the rocks, hove-to for the night."

"August 15.—. . . The weather having become fine, with only a moderate swell, sent a boat with a party to land on the rock; but the sea broke so heavily round it that the officer in command thought it would be imprudent for them to do so. One of the party, Mr. Johns, the boatswain, succeeded in getting a footing, but not at the part where the summit is accessible."

Captain G. H. Inskip, R.N., who, though he did not land himself, was the officer in charge of the boat in question, has recently given[3] the following account of the landing:—

"The weather was fine and the sea smooth, but even with these advantages it was difficult work, and required care and patience to watch for an opportunity to pull the boat's bow in close enough to allow the man to jump out on to the rock. It would not have been prudent to have put the boat alongside, on account of the wash; but, by keeping her stem-on, and the men ready to back off in a moment, we managed it. In the same way, we got the man off again. By giving any one who has landed a line, and his jumping into the water, no time need be lost in re-embarking."

It appears[4] that the man who landed broke off, by means of the sounding-lead, which was thrown to him for the purpose, four or five pieces of rock, which he obtained all in one place, and that, wrapping them in his neckerchief, he threw them into the boat.

During the summer of 1869, the *Porcupine* again visited the rock. The late Dr. J. Gwyn Jeffreys, F.R.S., who was on board, says:[5]—

"While we lay-to within a quarter of a mile from Rockall on the evening of Saturday, the 3rd of July, fishing parties were formed and continued their sport until midnight. The rock was inhabited by a multitude of sea-fowl, and a large

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[1] *North Atlantic Sea-bed* (London, 4to, 1862).

[2] See *Nautical Magazine for 1862* (London, demy 8vo), pp. 564-565.

[3] In a letter addressed to Mr. R. M. Barrington in 1884.

[4] From another letter written to Professor T. Rupert Jones.

[5] *Proc. Roy. Soc.*, vol. xviii. (1870), p. 422; also *Nature*, vol. i. (1870), p. 136.

(1)

(2)

ROCKALL.

(1) From the SE. by S. (2) From the SW. by W.

(*From Photographs by the Rev. W. Spotswood Green and Mr. Charles Green*, 1896.)

gannet, perched on the highest pinnacle, looked like a sentinel, or the president of the feathered republic."

Since 1861, Rockall Bank has been annually visited by fishing-boats from various British and Irish ports (as will be more fully noticed hereafter), and members of their crews have from time to time been able to effect a landing upon the rock itself. Thus, in the summer of 1887, the crews of two such vessels, the *Dolphin* and the *Gauntlet*, among them being Captain Johannes Hansen, of Thorshavn, landed. Naturally, however, the result of the observations of such men has been of small scientific interest.

In March 1892, there was published[1] anonymously an account of a visit to Rockall, which appeared, at first sight, to possess extraordinary interest, as it gave a detailed account of the avi-fauna of the rock, and declared that the Little Auk (*Mergulus alle*) bred upon it. Inquiry by eminent Scottish naturalists quickly showed,[2] however, that the article, though published in perfect good faith, was a hoax, being altogether imaginative and spurious, and that the writer had never visited the rock, as he claimed to have done.

The only expedition ever despatched for the sole purpose of examining Rockall from the scientific point of view was made in the summer of 1896. It was undertaken on the initiative of the present writer, though organised by Mr. R. M. Barrington, F.L.S., the Rev. W. Spotswood Green, M.A., of the Fisheries Board, Dublin, and several other gentlemen, acting as a committee of the Royal Irish Academy, which learned body voted a sum of money for the purpose. A sum of equal amount was contributed jointly by Messrs. R. M. Barrington and J. A. Harvie-Brown. The fine steamer *Granuaile*, belonging to the Congested Districts Board, having been chartered by the Academy on liberal terms, and the necessary trawls, dredges, sounding apparatus, rope-ladders, and scientific apparatus having been placed on board, a departure was made from Killybegs, Co. Donegal, on June 3rd. The party on board consisted, in addition to the three gentlemen named above, of Messrs. R. Lloyd Praeger, W. de Vismes Kane, H. L. Jamieson, and C. Green. Rockall was sighted at daybreak on the 5th, but the state of the weather prevented any attempt at landing. The vessel lay-to to await an improvement; the trawl was shot as often as an opportunity offered itself; and sketches were made and photographs taken of the rock; but, the coal-supply having given out, a return to Killybegs became necessary, and that place was reached on the evening of the 8th.

On the evening of the 13th (the reports from Tory Island, Sumburgh Head, and other points, indicating a probability of finer weather), the party started from Killybegs on a second attempt to reach Rockall; but, when the rock was again sighted, at daybreak on the 15th, the weather was as unfavourable as before, and landing was a total impossibility. Whilst again awaiting an improvement, the time was spent in trawling

[1] See *Chambers's Journal*, vol. ix., pp. 161-163.

[2] See *Ann. Scot. Nat. Hist.*, 1892, p. 197; also *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895), p. 68.

and dredging at spots where the nature of the sea-bottom permitted, and some very interesting results were obtained. The weather, however, did not improve, and, the coal-supply having once more become exhausted, a return became necessary. After spending a few hours at St. Kilda, the ship entered the harbour of Londonderry on the 18th. Although the party thus failed to effect a landing upon either of the two attempts made so to do, the expedition obtained much interesting information. Excellent sketches and photographs of the rock (already alluded to) were obtained, and these are reproduced to accompany the interesting report of the expedition written by the Rev. W. Spotswood Green.[1] Much information relating to the ornithology of Rockall, and a good deal bearing upon the zoology of Rockall Bank, was obtained, as will be noticed hereafter. The failure to land is chiefly to be regretted from the point of view of the geologist and the student of terrestrial magnetism.

IV. Its Points of Scientific Interest.

Having now discussed the nature, position, and history of Rockall, it remains to inquire what points of scientific interest it presents.

There is no point in connection with Rockall which is of greater general and practical importance than its meteorology. Standing, as the rock does, far out in the Atlantic, to the westward of Britain, its value to the inhabitants of Europe, and especially to the inhabitants of the British Isles, as a meteorological observing-station might be enormous. If it were possible to establish such a station upon the rock, connected by a cable with the mainland, our meteorologists would receive earlier and more definite information of the approach of cyclonic disturbances from the westward, and the science of weather-forecasting would be immensely simplified. No less high an authority than Dr. R. H. Scott, F.R.S., the Secretary of the Meteorological Office, has declared[2] that—

"If a station on Rockall could possibly be established and maintained, its value to weather-telegraphy would be incalculable ; but [he adds] there are one or two fearful *ifs* :—

"(1) *If* the place can be built upon ;

"(2) *If* the communication by wire can be kept up ; and

"(3) *If* any one will live there."

The idea of establishing an observing-station on Rockall is by no means new. The advantages of doing this, if possible, are so great and so obvious that the matter long since received the careful consideration of the British Meteorological Authorities, whose attention has recently been again directed to it. The labour and expense, however, of landing workmen and supplies ; of excavating foundations for and erecting, first storehouses and workshops, and subsequently a lighthouse or observatory ; of making the soundings necessary before a cable could be laid ; of laying the cable itself (without which the station would be valueless) ; and of keeping up the supplies of the station when established—the

[1] *Trans. Roy. Irish Acad.*, vol. xxxi. (1897), pp. 39-47. [2] *Ibid.* p. 64.

labour and expense of all this would be so great that no attempt has yet been made to utilise the natural advantages of Rockall as an observing-station.

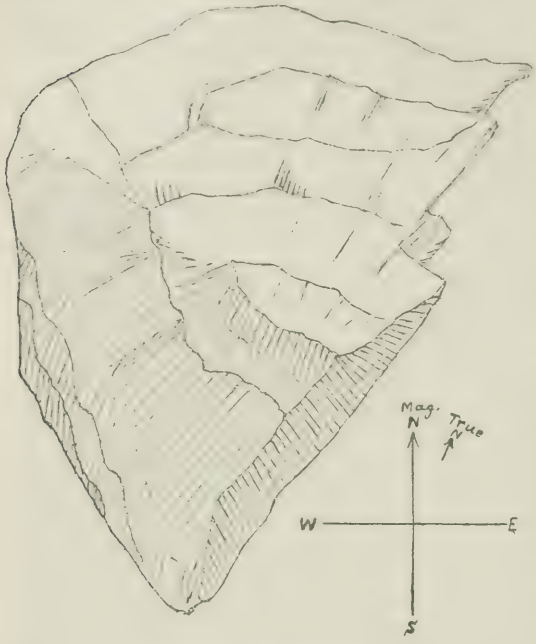
Considering the very limited area presented by the rock, its remoteness from any other land, and the fact that in winter the waves undoubtedly far over-top its summit, it may well be doubted whether the establishment, actually upon the rock itself, of a lighthouse or observing-station is, or ever will be, a practical possibility. On the whole, it seems that a far cheaper, simpler, and more feasible plan would be to moor a lightship on some portion of Rockall Bank, adjacent to the rock. This would serve both as a warning to seamen and as an observatory. In either case, however, the cost of laying a submarine telephone or telegraph cable would have to be met, and this would be great, perhaps £35,000 or £40,000. It is true that, some years since, the managing-director of the Telegraph Construction and Maintenance Company expressed[1] grave doubts as to the feasibility of mooring a vessel permanently in such deep water, or (if this were done) of getting any one to live in it on account of the incessant pitching and tossing, or of maintaining efficient cable communication with the mainland. It seems certain, however, that this gentleman unduly exaggerated the difficulties to be contended with; for Admiral Sir William Wharton, the present Hydrographer to the Admiralty, has expressed[2] his belief in the possibility of both mooring a ship under such circumstances and of living in it without unreasonable discomfort afterwards; while the problem of maintaining cable-communication with lightships has been successfully solved in various places round our coasts. The only real difficulty in establishing an observatory and lightship on Rockall Bank appears to be the great cost of the very long cable that would be necessary. Without doubt, however, the time will come when this difficulty will be successfully overcome.

On the Admiralty chart of Rockall before alluded to,[3] it is stated that, "The compass-variations very near the rock were such as to induce the supposition that it is highly magnetic." On this point, any one fortunate enough hereafter to be able to land upon the rock might easily make definite observations. The chief cause of local magnetic attraction in such rocks or islets is the presence of the magnetite of basalt, but this is not as yet known to form part of Rockall.

The geology of Rockall is a matter of much scientific interest, upon which any visitor hereafter landing upon the rock might easily throw very important light. At present, almost nothing sufficiently full and definite to be deemed satisfactory is known as to the nature of the rock of which Rockall is composed; yet the desirability of procuring definite information upon this point will be obvious to any one possessing even a smattering of geological knowledge. Rockall presents an almost unique exposure of rock, indicating the nature of the rock-formations

[1] *Journ. Roy. United Service Instit.*, vol. xxxvi. (1892), p. 506.
[2] *Ibid.*, pp. 511-512.
[3] See *ante*, p. 396.

constituting the ocean-bed, at a point intermediate between several more or less distant lands, namely, Greenland, Iceland, the Faroes, the Hebrides, and Ireland. A knowledge of the geographical structure of Rockall would, therefore, be of great interest as affording a sure indication of the nature of the rocks forming the bed of the North Atlantic, and as showing whether those rocks were similar to, or dissimilar from, those of the most nearly adjacent lands referred to above. Except from such rare exposures of rock as that afforded by Rockall, it is practically impossible to obtain satisfactory evidence of the nature of the rocks forming the beds of oceans, and of their relationship (if any) to the rocks of which the lands surrounding those oceans are composed.



SKETCH-PLAN OF ROCKALL.
(*From a Drawing by the Rev. W. Spotswood Green*, 1896.)

When Basil Hall visited the rock in 1810, small fragments were broken off and brought away. These were distributed to various museums, but none of them seems to have been carefully examined at the time. Again, in 1862, when the rock was visited by Captain Hoskyn, in H.M.S. *Porcupine*, specimens were again procured, as already mentioned, and brought home. Some of these were distributed among the leading Irish Museums (including those of Queen's College, Galway, the Geological Survey of Ireland, and the Belfast Museum), while others were preserved by Lieutenant (now Staff-Captain) G. H. Inskip. One of these specimens was examined soon after by the late Mr. David Forbes,[1] whose conclusions (which do not seem to have been very reliable) attracted but little attention.

The first systematic attempt to decide the rock-structure of Rockall seems to have been made on the initiative of Mr. J. A. Harvie-Brown, who sent to Prof. F. M. Heddle, F.R.S.E., for examination, a fragment of rock obtained by Mr. John Cordeaux, of Great Cotes, Ulceby, Lincolnshire, from a Grimsby smacksman, John Barr by name (since dead), who

[1] See *Proc. Roy. Soc.*, vol. xviii. (1870), pp. 491-492.

some years ago collected it on the bank whilst line-fishing for cod, a piece of branching coral growing upon it having become affixed to his lines. As, however, it appeared probable[1] that this fragment never formed part of, and differed in structure from, Rockall itself, its nature need not be considered here in detail.

Recently, a fragment broken from the rock when Basil Hall landed in 1810, and two fragments procured when the *Porcupine* visited it in 1862, have been carefully examined by Prof. J. W. Judd, F.R.S., who, having also examined the photographs and sketches of the rock procured by the Rev. W. S. Green, during the recent (1896) expedition, has reported[2] as follows :—

"Rockall is . . . [apparently] a portion of a great intrusive sheet of igneous rock, now lying in an inclined position upon stratified masses, which are seen on the south-west side of the rock. The igneous mass shows very marked rectangular jointing, and is thus described by Mr. Green in a note which he has obligingly communicated to me :—

"'The east face seemed like a great slab of gray granitoid rock (and I was within twenty yards of it), with rectangular joints broken off at the north, so as to show the square edge of another slab, and this was in turn broken off, showing the face of a third. . . .[3] [All this granitoid mass] rests, as you suggest, on a rock, showing a kind of bedding or jointing, dipping about east, and at an angle of 30° or so.'

"So far as I know, no specimen has ever been obtained from this underlying mass, on the west or south-west of the rock, and it is impossible to say whether it consists of sedimentary materials, of stratified tuffs, or of some fissile igneous rock. The general relations of the rocks of Rockall strikingly resemble those of the Shiant Isles, north of Skye, where we have the ends of a great inclined sheet of dolerite, resting on stratified clays, into which the igneous rock was intruded.

"Most observers have agreed that the material composing the greater part of Rockall resembles a 'granite,' and all three of the specimens I have examined bear out this description. . . . The material appears to me to be undoubtedly a massive rock, and one of a new and very interesting type.

"The structure of the rock is, to the eye, perfectly granitic ; the essential minerals in it being three : colourless quartz, clouded felspar (albite), and black crystals of a ferro-magnesian silicate—soda-augite (aegirine and acmite). The peculiarities of the two latter minerals are not obvious from a megascopic inspection of the rock, and hence it might easily pass as an ordinary granite, or rather as a hornblende granite, using the last term in the original sense in which it was applied by its author, Gustav Rose.

"When the three specimens of the rock are compared, they are found to exhibit a remarkably close agreement in the essential features of their mineralogical constitution, and in their structure the differences are not greater than is often found in different portions of the same rock-mass. . . . All three of the specimens are somewhat drusy ('miarolitic') in character—in this respect resembling many others rocks of the class of granite porphyries. The drusy cavities are stained with brown decomposition products, indicating, probably, the former presence of secondary minerals within them.

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[1] See Harvie-Brown in *Proc. Roy. Phys. Soc. Edin.*, vol. xiii., pp. 65-66.

[2] *Trans. Roy. Irish Acad.*, vol. xxxi., pp. 49-51.

[3] This is shown, to some extent, by the sketch-plan on p. 408.

"Detailed microscopical study and analysis of the material of Rockall shows that it is as unique in mineralogical and chemical constitution as it is isolated in position. The rock consists of three minerals, a soda-augite (aegirine and acmite), quartz, and albite; accessory minerals, other than magnetite and apatite, appearing to be very rare in it."

After discussing in great detail the nature of the three specimens, their relation each to the other, and to other known rocks of similar character, Prof. Hull reaches the conclusion that Rockall is composed of a rock sufficiently different in character from all other known rocks to be deserving of a distinctive name. He, therefore, proposes to call it "Rockallite," and concludes[1] as follows:—

"Rockallite may be defined as a rock having the structure of the 'granite-porphyries' (*hypidiomorphic, granular*, and *miarolitic*), but belonging to the extreme variety of the soda-bearing acid rocks. It is an aegirine-quartz-albite rock, intermediate in structure and composition, between the soda-granites on the one hand, and the grorudites on the other, and presenting points of analogy with some soda-ceratophyres. Among lavas or effusive rocks, rockallite is probably represented by some of the quartz-pantellerites.

"With respect to the age and relations of the rock forming the singular isolated mass of Rockall, the materials for arriving at a judgment must be admitted to be very small. If the rock over which the igneous mass appears to have been thrust could be examined, and especially if it were shown to be a stratified rock with fossils, the evidence thus afforded would be of great value. At present, however, we have nothing but general analogies to guide us. The nearest resemblance to rockallite is found, as we have seen, among the Post-Silurian dykes in the Christiania district, so admirably investigated by Prof. Brögger; and it may be that in Rockall we have a similar intrusive mass of the same period, that has escaped destruction by denudation. But it must be remembered that among the Tertiary Rocks of the Western Isles of Scotland, in St. Kilda (which is the nearest land to Rockall), in Skye, Ardnamurchan, Mull, and Arran, we have granites and granite-porphyries containing soda-augites and soda-amphiboles. Some rocks approaching very closely in composition to rockallite are known to me among the Tertiary eruptives, and it is therefore by no means impossible that the rockallite belongs to the same recent period."

Prof. Grenville A. J. Cole, F.G.S., has carefully examined and reported upon[2] the rock specimens procured upon Rockall Bank by fishermen who have brought them up entangled, by means of attached corals, among their lines, and by the recent (1896) expedition, whilst dredging. He says:—

"The recent expedition . . . has revealed a great prevalence of basalt in the neighbourhood of Rockall itself. The specimens gathered by Mr. Cordeaux, from English fishermen who have visited the bank, consist, moreover, very largely of basalt.

"It is highly probable that the relics of a basaltic plateau lie submerged at Rockall bank, and that the material of the rock itself represents another phase of local igneous activity. The bank would find a fitting place in the petrographic

[1] *Loc. cit.*, pp. 57-58.
[2] *Trans. Roy. Irish Acad.*, vol. xxxi., pp. 58-62.

province which includes Iceland, the Faeroes, the Inner Hebrides, and the north-eastern counties of Ireland; and we must not forget that the whole Cainozoic era has elapsed since vulcanicity was established in this province. Hence there has been ample time for the volcanoes of the Rockall area to be denuded, and for their slopes and lava-fields to be strewn with boulders from further rounding and decay; and, similarly, the metamorphic region on the east has been carried down, with its taluses and stream-courses and moraines, to form the floor of the deep water between Rockall bank and Ireland."

It appears, therefore, that much might be ascertained as to the geology of Rockall by any person landing upon the rock who would take the pains to procure proper specimens, and to make exact and systematic observations. No skilled geological observer has ever yet landed upon Rockall, and all that we know of its structure has been gathered from the appearance of tiny fragments of rock broken off haphazard by persons possessing no geological knowledge whatever.

Prof. Hull has declared [1] that, in the Jurassic Period,

"the Atlantic area was probably distributed into ridges or islands, with intervening sea-lochs and basins, of which Rockall, Bus (or Busse),[2] and several of the little islets and sunken rocks in that portion of the Atlantic, between latitude 10° and 30° W., may be modern indications."

That very extensive subsidence has taken place in the Rockall region, within comparatively recent geologic times, has been shown [3] conclusively by Sir Archibald Geikie in his paper on "The Tertiary Basalt-Plateaux of North-Western Europe."

Allusion has already been made to the probability that, as lately as a couple or three centuries ago, not only was the main rock surrounded by an exposed sandbank of small extent, but the adjacent reefs had a greater exposure than now. On a large globe of about the middle of the seventeenth century, preserved in the Bibliothèque Nationale, Paris,[4] a dotted line, which may be taken to indicate an exposed sandbank, surrounds the rock; and (as will be mentioned hereafter) many dead and bleached shells, belonging to species accustomed to live in quite shallow water, have recently been dredged up from portions of the bank, now covered by nearly 100 fathoms of water. On the same globe, and also on an interesting manuscript chart of about the year 1640, by Le Sieur Tassin, French Geographer Royal,[5] "Rookol" has represented adjacent to it a smaller rock, which (though in both cases incorrectly placed) probably represents either Haselwood rock or Helen's reef. Yet the latter, at least, was (as will be remembered) considered to be unknown when the *Helen* was wrecked upon it in 1824.

[1] *Contributions to the Physical History of the British Isles* (London, roy. 8vo, 1882), p. 101.

[2] The present writer has been able elsewhere to show that the legendary "Land of Busse," here referred to, never had any real existence (see *Danish Arctic Expeditions, 1605-1620*, book i., pp. 164-202; Hakluyt Society, 1897).

[3] *Quart. Journ. Geol. Soc.*, vol. lii. (1896), pp. 399-405.

[4] *Cartes*, Inv. 5.

[5] Reproduced in *Scient. Proc. Roy. Dub. Soc.*, vol. ii. N.S. (1879), pp. 173-176; also in *Journ. Geol. Soc. Irel.*, vol. v. (1880), pp. 128-131.

To the zoologist, Rockall presents many points of considerable interest. Every one is aware of the special interest which pertains to a study of the fauna of oceanic islands. Rockall may certainly be so designated, and it is the only island adjacent to Britain to which the term may be correctly applied; but, unfortunately, in its case, the area is so extremely small that one could not reasonably expect to find a distinctive fauna, such as often characterises isolated oceanic islands, or even a distinctive species of any kind, existing upon it. Nevertheless, it may be truly said that the fauna of Rockall possesses an interest far above that of any other similar rock or islet lying close to our shores.

The captain of a Grimsby smack has asserted[1] that "Grey Seals" (*? Halichœrus gryphus*) at times frequent the ledges around the base of the rock. It is not likely that any mammalian animals, other than seals, are ever to be found there.

Ornithologists, until recently, awaited with keen anticipation any precise information concerning the avi-fauna of Rockall. It had long been known that the rock is frequented, at least during summer, by large numbers of sea-birds, and that its summit is (as already stated) permanently whitened by their droppings. Any species which might casually resort to the rock during autumn or winter would prove of small interest, but the case was different with those species found upon the rock during summer, for the probability was that they, or some of them, bred upon it. Even if these proved to be species breeding more or less commonly upon the nearest Scottish or Irish coasts, the extension of their known breeding-area to any such locality as Rockall would be a matter of interest; but there remained also the possibility that the rock might form a breeding haunt of other species, not known to breed in Britain, such as the Greater Shearwater (*Puffinus gravis*), Bruennich's Guillemot (*Uria bruennichi*), or the Little Auk (*Mergulus alle*)—indeed, the writer of the bogus article referred to above[2] stated explicitly that the last-named species did breed upon the rock. It is little wonder, therefore, that ornithologists were keenly anxious to know what species, if any, bred upon the rock, notwithstanding the fact that, owing to its extremely small superficial area, the number, both of species and individuals, frequenting it for breeding purposes must necessarily have been small.

The first definite information was obtained through the industry of Mr. Harvie-Brown. That gentleman has published[3] the statement of Captain Johannes Hansen, of Thorshavn, who asserts that, when he landed upon the rock in 1887,[4] "several" species of birds were breeding on it, and that he and his companions brought away as food "a boat-load of eggs." He only brought home, however, a single egg, which is now in Mr. Harvie-Brown's possession, and is apparently that of the Common Guillemot (*Uria troile*), though possibly that of Bruennich's Guillemot.

The recent expedition, though unable to effect a landing, obtained, nevertheless, a good deal of information concerning the avi-fauna of the

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[1] *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895) p. 68.

[2] See *ante*, p. 405.

[3] *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895), p. 69.

[4] See *ante*, p. 405.

rock. In the report,[1] we are told that, in June 1896, the bird-population of the rock itself consisted, at a rough guess, of about 250 Guillemots, 50 Kittiwakes (immature), 30 Puffins, 10 Gannets (of which eight were immature), and (possibly) a few Razorbills. Over or near the Bank, fourteen other species of bird were seen in greater or less numbers, including several species of Gull, Tern, and Skua, the Fulmar (*Fulmarus glacialis*), the Manx Shearwater (*Puffinus anglorum*), and the Great Shearwater (*Puffinis gravis*). The last-named interesting species (of which the breeding-place is unknown, though it has a wide range of distribution over the Atlantic) was seen in numbers over the Bank, either singly or in small flocks, seldom in pairs, apparently feeding or resting, but certainly not breeding on the rock.

Of the birds actually seen upon the rock, the Guillemot was thought to be probably breeding; but this was not the case with any of the other species named. Most of the individuals were immature, and it seems probable that Rockall and its Bank form a great summer resort for many young non-breeding birds of the species named.

The information obtained by the recent expedition is more ample and more satisfying to ornithologists than to students of any other branch of science; but, for fuller particulars, the reader must be referred to Messrs. Harvie-Brown and Barrington's excellent paper cited above.

To the botanist, Rockall is of little or no interest. Some smacksmen informed Mr. Harvie-Brown and Mr. Cordeaux that they had observed scanty vegetation growing upon the rock, but none such was observed by the members of the recent expedition, and it seems very doubtful if any phænogamous plant could exist in such a locality. There may, however, be some kinds of lichen growing upon the rock; and, without doubt, there are seaweeds. Specimens of either should be obtained and brought home by any future visitor.

Turning now from the zoology of Rockall itself to that of the Bank surrounding it, one must take note first of its fish-fauna—the only point of view from which the place can be said to present an aspect of direct commercial interest. The fishery on Rockall Bank has been prosecuted with more or less energy since the year 1861. It appears[2] that, in August of that year, a certain Captain Rhodes, master of a smack, when crossing Rockall Bank on his voyage home from Greenland, accidentally let down his lines. No sooner were they down, than several large cod were at once hooked. Down went the lines again, and more fish were at once hooked. This went on at such a rate that, "in an incredibly brief space of time, fourteen tons of large beautiful cod-fish were taken, valued at £10 per ton; and, having exhausted their salt and other stores, the delighted fishermen set sail for Westray in Orkney, where they astonished the natives with their marvellous narrative." Two or three other vessels at once went out and met with similar success; but, the winter coming on, operations had to be suspended. Meanwhile, however, a company

[1] By Messrs. J. A. Harvie-Brown and R. M. Barrington (see *Trans. Roy. Irish Acad.*, vol. xxxi., pp. 66-75).

[2] See *Chambers's Journal*, vol. xviii. (1863), pp. 364-366.

was organised and preparations made for the following year's campaign. This by no means came up to all that was expected of it; and, since that time, the Rockall fishery has not been worked by any organised company, though regularly visited by fishing vessels from various English and Scottish ports. Grimsby and Greenock appear to be the ports from which these vessels now chiefly come. Some come from Færo and others from various ports in the Hebrides and on the western coast of Scotland. Few, if any, now go to Rockall from Peterhead or Fraserburgh.[1] As regards Hull, Captain Barron says:[2]—

"Several fishermen from Hull have fished on the banks around it [*i.e.* Rockall], and have obtained good catches of cod, which attain to a great size; but, owing to the wild state of the weather, that part of the sea for fishing is not often frequented."

Any expedition properly equipped for carrying on dredging operations upon Rockall Bank would certainly be able to bring home material of much interest to students of marine zoology; but an ordinary yachtsman visiting Rockall would probably not be able to accomplish much in this direction. The first to dredge the bank was the late Dr. J. Gwyn Jeffreys, during the cruise of the *Porcupine* in 1869.[3] In 1896, Mr. John Cordeaux presented to the British Museum (Natural History) and the Museum of the Royal College of Science, London, collections of corals and other marine organisms brought up attached to the lines of Grimsby fishermen when fishing on the bank.[4] During the recent expedition (1896), a small amount of good dredging work was accomplished, and the results are dealt with by various writers in the *Report* on the expedition[5] as follows:—The Mollusca, by Mr. A. R. Nichols, of the Science and Art Museum, Dublin; the Crustacea, by Messrs. W. T. Calman, B.Sc., and E. P. Wright, M.D.; the Chætopoda, by Prof. M'Intosh, F.R.S.; the Echinodermata, by Mr. W. Percy Sladen, F.L.S.; the Polyzoa, by Miss L. R. Thornley; the Hydrozoa, by Miss L. R. Thornley; the Actinozoa, by Prof. A. C. Haddon, D.Sc.; and the Spongida, by Prof. Robert von Lendenfeld.

The mollusca obtained were of sufficient interest to deserve special notice here. On the 15th June, the dredge was lowered at a spot fifteen miles south from the rock, where the water was 100 fathoms deep and the bottom consisted of fine sand.

"In a haul of about twenty minutes [says the Rev. W. Spotswood Green[6]], the water shoaled to 80 fathoms; and, when the trawl came up, we found in the bag a most unexpected assortment of shallow-water shells, evidently long since dead. Amongst these were several kinds of *Pecten*, *Venus casina*, *V. fasciata*, *Mytilus modiolus*, etc. How, under present conditions, such shells could be found living anywhere on the bank was difficult to understand. . . . There is, of course,

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[1] J. A. Harvie-Brown in *Proc. Roy. Phys. Soc. Edin.*, vol. xiii. (1895), p. 72.
[2] *Old Whaling Days* (Hull, crown 8vo, 1895), p. 179.
[3] *Proc. Roy. Soc.*, vol. xviii. (1870), p. 490.
[4] See *Trans. Roy. Irish. Acad.*, vol. xxxi., p. 97.
[5] *Ibid.*, pp. 76-88.
[6] *Ibid.*, pp. 45-47.

the possibility that these shells may have come from the bottom of icebergs which had grounded in Greenland or Spitzbergen bays; but I doubt if, in times sufficiently recent, such bergs have visited the position occupied by Rockall. . . . The possibility of the shells having been brought as bait for the lines of the fishing-boats visiting the bank is, I think, disposed of by the mixed character of the deposit, some of the shells being unsuitable for such a purpose. It would be interesting to trace out the area occupied by these dead shells, . . . but the time at our disposal only gave us the chance of one dip into this deposit."

Mr. A. R. Nichols has been good enough to send me for examination one of the shells dredged on this occasion. It is perfectly white and in an exceedingly soft friable condition, having lost all trace of animal matter. The presence of these shallow-water shells, evidently long since dead, lends strong confirmation to the surmise, already advanced and supported by several facts cited, that Rockall and its bank have recently undergone considerable depression or erosion, or both. Doubtless, these shells lived upon the Bank when the water over it was much shallower than now, probably not more than 20 to 50 fathoms in depth, the latter being the greatest depth at which any of these species are commonly found living; and, as the depth increased, they doubtless died.

V. Concluding Remarks.

From the foregoing it will be gathered that, although much more is now known concerning this extraordinarily interesting speck of oceanic land than was known even a few years ago, much that is of interest still remains to be learned about it. It is, perhaps, improbable, after the failure of the recent expedition to effect a landing, that another properly equipped expedition will be undertaken on purpose; but there are surely plenty of British and American yachtsmen, owning stout sea-going steam yachts, who would be glad to have a definite and useful object for a short ten-days' cruise, accompanied by some scientific friend, during next summer. To any such, a trip to Rockall may be recommended. Any such expedition should not be undertaken earlier than the middle of May or later than the beginning of July, between which dates the birds frequenting the rock would be found breeding, and there would be a fair probability of meeting with fine weather. It is true that there would always be a possibility that the weather, at the time of the visit, might not permit of a landing being effected; but a few days' dredging on the bank would certainly afford results of much interest to students of marine zoology; and, even if nothing of scientific interest were accomplished, a cruise would have been enjoyed.

In compiling the foregoing remarks, I have (as stated) drawn upon and cited the writings of all who have recently treated of the subject. I have also to thank many of these gentlemen for kind assistance rendered to me personally or by correspondence. Among these, I have especially to thank the Rev. W. Spotswood Green (to whom I am indebted for the drawings and photographs from which the accompanying illustrations have been made), Prof. T. Rupert Jones, and Messrs. Barrington, Cordeaux, Harvie-Brown, and Scott.

RECENT HYDROGRAPHIC RESEARCH IN THE NORTH AND BALTIC SEAS.

THE Swedish Academy of Sciences has lately published a report by Professor Pettersson and Herr G. Ekman on the results of the international examination of these seas in 1893 and 1894, as well as on the work of the Swedish commission down to the end of 1896.[1] As this report forms a sequel to the account of the earlier Swedish investigations given by Professor Pettersson in vol. x. of the *Magazine*, readers who are interested in hydrography may be glad to hear of the modifications revealed by subsequent examination.

The authors treat first of

The Condition of the Skagerack and Kattegat at the end of May 1893.

As shown in the second part of Professor Pettersson's article, vol. x. p. 352 and p. 413, the surface waters of these narrow seas are twice a year subject to displacements which involve important alterations from hydrographic and biological points of view. The winter surface water or bank water (of 32 and 33 *pro mille* salinity) was, at the beginning of May 1893, being thrust out and replaced by the increasing efflux of the Baltic stream. At all times this stream exhibits a tendency to bifurcate at the mouth of the Kattegat. But in summer this tendency becomes more latent, and is perceptible only at a certain depth below the surface, the two branches in consequence of their large volume spreading themselves out over the whole Skagerack and flowing together on the surface. In winter, on the other hand, the Baltic stream is too small to cover the surface, and bifurcation takes place, especially when the wind blows from the east, a broad belt of Baltic water passing out westwards by the Skaw, and another branch flowing on the surface along the Swedish coasts, and, reinforced by the efflux from the river Glommen and the Christiania fiord, skirting the southern coast of Norway and passing Lindesnæs. All the middle part of the Skagerack is then covered by bank water to a depth of 20 to 30 mètres, with a temperature gradually falling to between 3° and 4° C. On the coast banks it is even deeper than in the middle of the Skagerack, but for the most part is covered by the Baltic water. The bank water enters the Kattegat in winter as an under current, which consequently in spring carries cold water (of about 3° C.) into the deep channels of the Kattegat and the western Baltic.

Such was the condition in the winter of 1892-93, and the irregularity of the isohalines marking the limits of the different kinds of water indicate that a rapid change was taking place in the surface layer, the bank water being mingled with and driven forth by the outflowing Baltic water. Both in winter and summer this blended water (coloured dark buff on the

[1] *De Hydrografiska Förändringarne inom Nordsjöns och Östersjöns Område under tiden* 1893-1897.

charts in vol. x.), which has a salinity of 30 to 32 *pro mille*, plays a very subordinate part, but in May, when displacement of the waters occurs, its importance is far greater. The removal of the bank water is due not solely to the intrusion of another current, the Baltic, but is also a consequence of the under layer of very salt water (35 *pro mille*) rising to a higher level. Thereby also the superincumbent layer of 34‰ salinity (coloured light blue) also attains a higher level, though its depth may not be increased. This welling-up of the lower salter layers is no doubt caused immediately by the reaction of the increasing surface current, though the pressure of 35 water towards the Skagerack assists during spring. The fact, first shown by the Swedish observations in 1890, that the saltest waters in the Skagerack well up during spring and summer and sink to lower depths in winter, has since been fully confirmed, especially by the Norwegian hydrographers, and proved to obtain over the whole North Sea area; Dr. Hjort found that on the Norwegian Atlantic coast the 35 water was subject to changes of level amounting to several hundred metres. The bank water thus displaced disappears so entirely before the inflowing Baltic water that during May it is never found in the whole central part of the Skagerack. Close to the coast banks, however, a great part of the bank water remains during the following months under the fresher surface water, and rises in temperature. It lingers still longer in the fiords, not being driven out till the great changes take place in autumn.

Early in May the bank water had become greatly thinned out, and it is remarkable that it disappeared first from the central and north-eastern Skagerack, and later from the south-western part.[1] It is there, then, that the coast current or the eastern branch of the Baltic stream increases most in strength, and drives out the bank water from the northern part of the Skagerack. This may also arise from purely mechanical causes, for during spring, when the Baltic stream runs with greater velocity, it must be more influenced by the rotation of the earth, and sends the greater part of its waters along the eastern shore of the Skagerack. And, as in spring it first overflows the northern and eastern Skagerack, driving out the bank water, so in autumn it remains longest in this area. It has been repeatedly found on the surface of the north and centre of the Skagerack in September and October, and in December 1896 almost the whole of the Skagerack north of the line C_1 to C_5[2] was covered with a thin and fresh layer of Baltic water. But this was an abnormal season, as shown by the failure of the winter herring fishery.

As to the Kattegat, the inflowing under current during the winter 1892-93 consisted of bank water from the surface of the Skagerack. When in spring the bank water is removed from the North Sea, it also ceases to pour into the Kattegat, and 34 water begins to force its way in, which in summer forms the bottom layer in the Kattegat. Danish investigations were made at the beginning of May 1893, just at the time of the

[1] The condition of the Skagerack early in May is shown in section 5B, Plate vii., vol. x. p. 358.

[2] These stations are marked on the charts between pp. 356 and 357 in vol. x.

movement of the water in the lower layers, and revealed many peculiarities at the mouth of the Kattegat and in its northern part, as regards both salinity and distribution of temperature.

The most striking features were two :—

(1) The salinity along the section from Vinga to Læsö Trindel was unusually low from the surface down to 50 mètres (under 30‰), which shows that the Baltic stream was of unusual depth just in front of the mouth of the Kattegat, whereas on the northern section, the Skaw to Paternoster, its depth was only 10 mètres near the Swedish coast, and on the southern section, Varberg to Kobbergrundet, about 10 to 15 mètres. Dr. Rördam, the chemist to the Danish expedition, ascribes the phenomenon to the damming up of the Baltic stream by the strong north-east wind that prevailed at the time.

(2) The deep water of the Kattegat was divided into two regions of different temperature. North of Læsö and Kobbergrundet the temperature was 5° C. or more, while in the whole of the sea south of Kobbergrundet it was below 4° C. (often between 2° and 3°). Rördam, from an examination of all the lightship records, concludes that this distribution of temperature continued during a certain period, at least from the 1st to the 10th May, and attributes it to the unequal distribution of the ice during the preceding cold winter. The ice must, he thinks, have remained longer in the north and north-west, and have exercised a cooling influence on the bottom waters.

Certain circumstances, however, indicate that the explanation of these phenomena must be sought for in other directions. The Kattegat is not a land-locked sea so homogeneous in constitution that vertical circulation can be set up from the surface to the lower layers, but it is a channel connecting two large volumes of water of different character, whence issue streams of very different salinity. The differences of salinity and gravity in the surface and under currents are so great that vertical circulation is absolutely confined to the upper layer, and a covering of ice can have no effect on the bottom temperature. Even in the Baltic the differences of salinity, 7 and 9‰, are sufficient to check the vertical circulation in winter, so that the sinking particles stop at the isohaline of 8‰, where the minimum temperature of the Baltic is, accordingly, found. The still greater differences, 20 to 25‰ and 33 to 34‰, in the Kattegat exclude all possibility of vertical circulation. In the Bohuslän fiords the Baltic water on the surface has been found cooled down to −1° C., "bottom ice"[1] forming 8 mètres below the surface, while the under layer at 14 mètres had a temperature of +1° C., and at 30 mètres of 4·4° C., with a salinity of 32·3‰.

The singular distribution of temperature must, then, be explained by the behaviour of the under current, and be regarded as a consequence of the great changes that take place in the Skagerack in spring. The 32-33 water, which in winter forms the surface layer in the Skagerack, and by the end of that season has cooled down to 3° to 4° C., and in that state enters the Kattegat as an under current, begins early in spring to

[1] The formation of this ice is explained in vol. x. p. 537.

flow out, and a warmer water, the 34 water, takes its place as an undercurrent in the Kattegat. The Danish expedition just chanced on the critical moment, when the new under current had advanced only a short distance into the Kattegat, while south of Kobbergrundet still remained the cold bottom water of the winter stream. Between them the Baltic water formed a partition extending to a depth of 40 to 50 mètres. North of it the salinity was 34‰, south of it most certainly 33‰.

The Condition of the Skagerack and Kattegat in August and September 1893.

In summer the Baltic stream usually covers the surface of the Kattegat and the greater part of the Skagerack, and also flows out over the Norwegian deep channel, making a decided bend at Lindesnæs, its most constant point of bifurcation, whence the western arm advances into the North Sea, losing itself at about 4° E. long., while the main current sweeps up along the Norwegian coast as far as observations have been extended.[1] Its depth, as shown on a line of soundings from Gothenburg to Christiansand, is only about 10 mètres, and in the middle of the Skagerack, at stations C_{II} and C_{III}, it immediately overlies the so-called North Sea water, with 34 and 35‰ salinity and a lower temperature. This is a water of totally different origin and character, a water that, entering from without, attains its highest level in the Skagerack in spring and summer, and thence finds its way as an under current (reaction stream) into the deep channel of the Kattegat, which in summer has a comparatively cold bottom layer, of 34‰ salinity as a rule.

Such was the arrangement in 1893. The inner southern ramifications of the Kattegat basin were in August filled with this kind of water, which lay immediately below the Baltic water in the midst of the Skagerack, as shown by observations at station C_{III} (long. 8° 57′ 0″ E., lat. 58° 0′ 25″ N.) Here were found the following sharply defined waters:—(1) Baltic water down to a depth of 10 mètres, with a high temperature, 16·8° C., and low salinity, 27‰; it had a normal percentage $\left(\frac{100\,O_2}{N_2+O_2}\right)$ of oxygen, 33·33, and a relatively low amount of nitrogen, 11·5 cc. per litre, showing that it had absorbed air at summer temperature, 14·5° C. (2) North Sea water from 10 down to about 35 mètres, with a salinity between 34 and 35‰, and a temperature of 6·7° to 9·15° C. Its upper layer was considerably supersaturated with oxygen, as shown by the extraordinary high percentage, 36·78 at 10 mètres and 37·31 at 20 mètres. It must have absorbed air in a cooler area or in winter, for the amount of nitrogen, 13·69 cc. per litre, corresponds to an absorption temperature of only 3·8° C. This supersaturation may be ascribed to the circumstance that the water, when on the surface of the sea, contained chiefly vegetable plankton, which gives off oxygen by a process of assimilation.[2] The low proportion of

[1] See Chart facing p. 352, vol. x.

[2] See vol. xiii. p. 97.

carbonic acid, 45·74 and 46·86 cc. per litre confirms this view. (3) Atlantic water of more than 35 ‰ salinity, and temperature below 6° C., which filled the Skagerack up to 40 mètres from the surface. It had a low percentage of oxygen, 30 to 31, as is always the case with the oceanic water which finds its way into the depths of the Skagerack.

The fourth kind of water, bank water, was totally absent at stations C_{III}, C_{IV}, and C_V, that is, over the central parts of the Skagerack. It occurred, however, in a wedge-shaped layer under the Baltic surface water close to the Norwegian coast, at stations C_V and C_{VI}, on the eastern side of the sea off the Jutland reef at station C_{II}, and in the mouth of the Kattegat, where it appeared as a cuneiform layer of considerable volume. One of the most important facts connected with the hydrography of these seas is that *the southern bank water enters the Kattegat in the latter end of summer and the beginning of autumn.*

A chart at a depth of 30 mètres shows the bank water running between the colder and salter North Sea water towards the entrance of the Kattegat, and south of station S_{II} splitting up into two branches, one of which, the larger, makes its way into the deep channels of the Kattegat, while the other turns northwards along the coast of Bohuslän. This arrangement was clearly demonstrated by Swedish and Danish soundings all taken within twenty-four hours on August 1st, 1893, while the close proximity of two pairs of stations, Swedish and Danish, enabled the methods of the two expeditions to be compared, so that the material obtained was more abundant and reliable than has ever been known in the annals of hydrography. The entrance of the Kattegat was filled with bank water, at a temperature of 16° to 14° C. and with a salinity of 32 and 33 ‰, from 10 mètres to 50 mètres below the surface, a continuation of the stream along the north-west coast of Jutland. It filled the whole breadth of the Kattegat, and its presence could be traced by the increase of salinity and the fall of temperature (from 17° to 16°) in the 10 mètres layer of Baltic water immediately above it. Under the bank water was a layer of North Sea water, which accordingly constitutes the bottom layer in the Kattegat, and forms the bed over which the bank water flows. This water lay in the deep channel before the influx of the bank water, and was the bottom water during the preceding summer, as shown by the Danish observations.

The hydrographic situation up to the mouth of the Kattegat being thus represented from the Danish and Swedish observations, which are in complete harmony, it remains to follow the bank water current southwards through the Kattegat. Here the difficulty presents itself that the Danish determinations of salinity are no longer derived by chemical analysis, but are obtained by an hydrometer, a method which is not sufficiently exact for the purpose. The Danish marine officers supplied, however, excellent temperature series. At a station near Vinga the temperature was 8·45° C. at a depth of 64 mètres, and the salinity 31·7 to 31·9 ‰, but at a neighbouring Swedish station it was found that this temperature belonged to a layer of water having 34°/₀₀ salinity. This salinity accompanies a low temperature of about 8°, as

proved by observations at a Danish station in the entrance of the Kattegat, where the salinity was accurately determined. Here a fall in the temperature from 11·2° to 8·2° between the depths of 54 and 63 mètres was accompanied by a rise of salinity from 33·26 to 34·20 ‰, showing that here must lie the boundary between two different kinds of water. A similar break in the temperature series occurred at the more southern Danish station, from 11° to 8·8° between 36 and 54 mètres, but the determinations of salinity by hydrometer did not indicate the transition to a salter water. The bank water, therefore, can be traced in the southern part of the Kattegat only by the change of temperature.

The bank water, as shown on Swedish charts,[1] is a coast water which is constantly found along the German and Danish shores of the North Sea, as well as on the Norwegian west coast. It can enter the Skagerack from both directions, and therefore a distinction must be made between southern and northern bank water. There can be no doubt that the southern bank water results from a blending of Atlantic water, flowing in through the British channel, with the discharge of the large rivers that fall into the North Sea. The conditions necessary for the blending, namely, the meeting of different waters on a shallow bed, where they are exposed to currents and wave motion, are here fulfilled. In the North Sea the tidal currents and swells are so strong, not only on the coast banks, that over the whole area south of the Dogger the water is homogeneous, as regards salinity and temperature, from top to bottom. At all seasons the southern North Sea water shows a tendency to flow along the Jutland coast into the Skagerack, but at the end of summer and early in autumn this tendency becomes very marked, and gives rise to a current from the sea towards the Skagerack sharply distinguished from the other waters. As it is a surface current in the North Sea and up to the neighbourhood of the Skaw, it is influenced to a great degree by the wind, and the time of its flow into the Skagerack is marked by strong westerly winds, which are the immediate, though not the only or the fundamental, cause of the phenomenon. It is principally due to a general movement of the waters of the Atlantic and North Sea eastwards at this season, as indicated by Mr. Dickson's temperature charts.[2] As a consequence of the bank water being originally a surface current, it has a relatively high temperature, 13° to 16° C., and is well ventilated, having a proportion of nitrogen approximately corresponding to the absorption capacity of water of 32° and 33 ‰ salinity at that temperature, and a normal percentage of oxygen (33 and over). By its high temperature it contrasts sharply with the colder 34 ‰ water in the Kattegat.

On August 2nd bank water lay at a depth of 20 mètres, a warm, well-ventilated water with a low proportion of nitrogen, 11·6 cc., and normal percentage of oxygen. Along the Danish line, Skagerack to Paternoster, as well as at the Swedish station at Paternoster, bank water was found from 18 mètres down to about 55 mètres, though only at one of the Danish stations was the channel deep enough to show the change of temperature at the level of the North Sea water below: at the others

[1] See chart facing p. 352, vol. x.

[2] *Geographical Journal*, vol. vii., 1896.

the bank water reached to the bottom. The analysis of the water from the Danish stations was not carried out with all the exactness necessary for an elucidation of the circulation, but the analysis from the deep station, being apparently executed with rather more care, shows distinctly the transition from the bank water to the underlying North Sea water. At about 50 to 60 mètres there is a triple break in the series of observations—the temperature sinks from 14·4° to 8·8° C.; the salinity increases from 33·2 to 34·2°/$_{oo}$; and the nitrogen increases from about 11 cc. to about 13 cc. per litre. Yet in spite of these unequivocal signs of an actual boundary between waters of different kinds and origin, the Danish hydrographer groups together all the waters of the Kattegat of more than 30°/$_{oo}$ salinity under the general name of "west sea water," alleging that it loses heat and gains salinity in regular gradation down to the bottom of the Skagerack.

In reality, however, the under current consists of waters of different kinds and origin, of different characteristics and age, which partly overlie, partly give place to one another. The two most important constituents are North Sea water and bank water. Neither of these reaches to the bottom of the Skagerack, which is occupied by Atlantic water of over 35°/$_{oo}$ salinity. This water enters the channels of the Kattegat only occasionally, and did not occur within its limits in August 1893. Certainly water of 35·50°/$_{oo}$ to 36·1°/$_{oo}$ was reported from Danish stations east-south-east of Anholt, but these determinations are evidently incorrect, and only reveal the inadequacy of such instruments as the hydrometer in the study of such complicated problems as those connected with the under streams of the Kattegat. The saltest part of the under current consists of North Sea water of 34°/$_{oo}$ salinity, which is certainly not bottom water, but occurs during summer in the upper layers of the Skagerack. Its temperature varies inversely with that of the seasons, so that in summer it is the coldest water. In May 1893, the temperature minimum, 4·2° to 4·3° C., was found in this water at a depth of 20 mètres.

Hence is seen how the low temperature in the under current of the Kattegat in summer originates. In May 1st, 1893, North Sea water, with a temperature of about 6° C., had penetrated as far as Kobbergrundet, forming the warm area mentioned above, and forcing its way against a still colder water which, in the early part of the year, constituted the bottom layer. This was northern bank water of the same kind as was found in the same situation in February 1890. From May till August the North Sea water is predominant in the depths of the Kattegat and impresses its character on the under current. But no under stream approaches unmixed the thresholds of the Baltic; south of Anholt the inflowing lower stream is forced upwards and spreads itself through the shallow furrows of the great southern plateau of the Kattegat, where it comes in contact and mixes with the surface water and with the older bottom water already there. Hence it happens that the surface water is modified to such a degree that the Baltic stream, which crosses the thresholds of the Kattegat with a salinity of little more than 8 to 10°/$_{oo}$, has by the time it reaches the mouth of the channel increased

its salinity to 30‰. The Kattegat is pre-eminently the blending-ground of the North Sea and Baltic system, and this blending is entirely the work of friction. The water formed by an admixture of the older bottom water remains at the bottom, and, as a modified current with diminished salinity, makes its way to both thresholds of the Baltic in the Öresund and at Gjedser and Darsserort. In a tolerably pure state the under current extends to the southern part of the Öresund. All the Danish longitudinal sections through the strait show how the under current of considerable salinity thins out towards the northern edge of the threshold, only some 7 mètres deep. On the other hand the under current never passes unmixed through the Belts to the western Baltic. A longitudinal section through the Great Belt from the Ekman expedition of 1877 shows that the higher isohalines of the bottom stream bend down towards the southern slopes of the deep channel of the Belt, while a modified under current, of 30 to 31‰ at most, glides into the west Baltic basin. It is, however, plain that the inflowing stream from the Skagerack impresses its character on the whole lower stratum, for at those seasons when a cold stream sets in below from the Skagerack, the deep water in the western Baltic is also cold and *vice versâ*. It is well known that this water has a warm period in autumn and a cold one in the early part of the year, and that thereby singular changes are produced in the fauna.

Over the threshold of the Baltic, between Gjedser and Darsserort, the under current flows intermittently, and then past Rügen and the north and west coast of Bornholm comes to the first deep hollow of the Baltic east of Bornholm, where the density in the lower layers is such that no vertical circulation can take place.[1] It is now clear why the bottom temperature is in general so low. The Danish temperature charts exhibiting the state of the Kattegat at different seasons from 1891 till 1893 demonstrate most unmistakably that the under current is in general most pronounced, and advances farther into the Baltic, during spring and summer, when it consists of colder water partly formed of northern bank water which has entered the Kattegat in winter.

The above statement seems to be confirmed by an observation of Professor Cleve. In the southern Kattegat and east and west of Bornholm he found species of *Diatomacea* never found elsewhere except in Polar seas, and as Arctic forms occur at the surface in the northern bank water in January and February, they may have travelled to the Baltic with the under current in March. It is an interesting subject of inquiry whether certain forms have really survived all the changes in the Baltic Sea since the Glacial Period, or whether their presence may be explained by existing causes.[2]

In August 1893 it appears from the Danish temperature observations that North Sea water, with its usually low temperature, 9° to 6·5° C., flowed through the Kattegat and into the Öresund and Great Belt. In the western Baltic the bottom water did not consist of pure

[1] See vol. x. p. 619 *et seqq.*

[2] See note on Dr. Credner's history of the Baltic basin in vol. xii. p. 34.

North Sea water, but of a mixture having much less salt and rather higher temperature, 8° C. Over the cold bottom water was found southern bank water with its high temperature and low proportion of nitrogen. It is impossible to say precisely how far this water advanced southward, as only temperature observations are available. A thin layer seems to have extended down to the southern plateau of the Kattegat, covering the North Sea water at the bottom, and a branch to have entered the hollows at Fornæs, while another branch apparently entered the Öresund, as a temperature of 15·8° C. was found there at a depth of 18 mètres. This fact is of interest because the autumn herrings visit the Kattegat immediately after the influx of southern bank water. This water does not appear at this season to have penetrated into the western Baltic.

It has been stated that a smaller arm of the bank water stream branches off northwards from before the mouth of the Kattegat. This also runs below the surface, covered by the Baltic water, and along the Swedish coast banks meets with an older layer of the same kind (bank water of 32 and 33°/$_{oo}$), which it displaces. Passing over the question whether the latter is the remnant of the strong inflow of the previous winter or a later blending product, the Swedish hydrographers point out certain differences between the two. The older bank water had a lower temperature and higher proportion of nitrogen, as well as a smaller percentage of oxygen, than the fresh southern bank water which was flowing in on August 1st, 1893. Hence the former must have lain below the surface during the summer, while the southern bank water came straight from the southern North Sea, warmed and saturated with air at a higher temperature (14° to 16° C.). It contained new characteristic forms of plankton, and brought with it shoals of autumn herrings ready to spawn.

Observations at various points of the Bohus coast show how the southern bank water displaces the older water during the autumn months and sweeps over the banks on the Swedish coasts, to give place in the latter months of the year to a new inflow, that of the northern bank water. At the mouth of the Gullmar fiord the bank water level, marked by a salinity of 32°/$_{oo}$, was at a depth of 26 mètres. It was comparatively cool (32°/$_{oo}$ water 12° to 13° C., and 33 water about 8° C.), and had a comparatively large amount of nitrogen and a low percentage of oxygen. At a depth of 45 mètres the temperature, 8·6° C., and the quantity of gas, 13·36 cc., show that here lay the older bank water, which had parted with much of its oxygen; the nitrogen must have been absorbed at 5·7° C., that is, during a cold season. Very different was the water brought up from the same depth in the same place on August 31st; it contained 11·78 cc. of nitrogen, while its percentage of oxygen was 33·39, and its temperature 13·12° C. Thus during the month of August the older water in the lower layers was replaced by the new, and hence on August 1st the northern branch of the bank water cannot have advanced so far along the Bohuslän coast.

A month later the bank water had risen to a higher level, 7 mètres from the surface, with a temperature of 16° C. in its upper layers and 13°

in the lower. It then welled up to the surface over a small area opposite the Gullmar fiord, and drove out the old water from the fiord down to 45 mètres, the depth of the bank at the mouth; behind this, at 50 mètres, was found the old bank water, almost unchanged except through a loss of oxygen caused by the living organisms it contained.

During October and November the southern bank water mingled with a new inflow of bank water from the north, which, in February 1894, had entirely superseded the autumn inflow, and pervaded the whole Skagerack, in the middle at the surface, and as an under current at the Swedish banks and fiords. This northern water had a temperature of only about 3·6° to 3·9° C., and had absorbed air at a winter temperature (2·2° C.), as proved by its large proportion of nitrogen. Thus there are two inflows of 32 to 33‰ water into the Skagerack, a warm one in late summer and early autumn, and a cold one from the north during winter. The former contains plankton from the North Sea and British Channel, and its arrival coincides with the appearance of the autumn herrings in the Kattegat. The other contains Atlantic and Arctic forms, and arrives and departs contemporaneously with the winter herrings that visit the fiords of Bohuslän. Such were the movements of the bank water in the Skagerack in autumn 1893. How far the case was exceptional, or whether it is typical for the Skagerack at that season, can only be ascertained by observations continued during several years.

(*To be continued.*)

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Statistics of Iceland.—The population of Iceland has gradually increased during the century, except at the census of 1890, when it was about 1500 less than in 1880. In 1895 it had risen to 73,449, an increase of about 26,000 since 1801, not including the 9000 persons who have emigrated since 1872. According to the *Isafold*, the most important Icelandic newspaper, the number was much greater in old times, the population in 1096 being 104,753. These figures seem somewhat too high, considering the great loss of life through volcanic eruptions, earthquakes, and other catastrophes, though, on the other hand, the numerous deserted houses point to a greater density of population. In the seventeenth and eighteenth centuries the people suffered not only from years of scarcity, smallpox, the great eruption of the Skaptarjökull and other disasters, but also through the Danish trade monopoly introduced in 1602, which brought the island to the brink of ruin. From the end of last century the fetters of the monopoly were gradually loosened, though not entirely removed till the middle of the present, and with increasing prosperity the population also increased. The immediate consequence was a considerable emigration, especially from 1882 to 1887, chiefly to Winnipeg and the neighbourhood, but of late years it has been much restricted, in no small degree because means of supporting a larger number of inhabitants has been obtained, either by developing the existing industries or introducing new ones.

The average length of life has rapidly increased during the past seventy years. From 1827 to 1849 it was about 31 years; from 1850 to 1854, 41 years 8 months; and from 1891 to 1895, 54 years 4 months. This is due in the first place to a diminution in the mortality of children. Infants are treated and nursed more rationally, both children and mothers have better and more healthy food, and doctors and nurses are scattered through the country.

The commercial centres have made astonishing progress, the value of real property in the towns having been trebled between 1879 and 1895. The chief causes are the increased number of decked vessels, in which fishing can be pursued to greater profit, and the extended use of machinery in the manufacture of wool. The population of Reykjavik has risen from 307 in 1801 to 4200 in 1895. Agriculture also shows improvement. The cultivation of vegetables, an industry of quite recent introduction, now demands about 10 acres of ground, and yields about $1\frac{3}{5}$ bushels of potatoes and turnips per head of population. More labour also is expended in levelling and improving the land.

The number of cattle has fallen off rapidly since ancient times, while sheep feeding has been proportionally extended. About 1850 the latter declined, but the price of wool rose during the civil war in America. The foreign trade had a value of only some £168,000 in 1849, while in 1895 it amounted to £830,350. The chief exports are wool and fish, and both have increased in quantity, the latter enormously, during the past half century.

During the year 1897 it snowed on 53 days in Reykjavik, and rained on 127. There was no thunderstorm, but a slight earthquake shock was felt on September 2nd. The highest barometer reading was 30·4 inches on January 19th to 22nd, and the lowest 28 inches on December 26th. The greatest cold was 10° F. in the night of January 25th, and the greatest heat 64° at midday on July 27th. The mean temperature for the year was 42° by day and 36° by night.—*Globus*, No. 18.

Mean Atmospheric Pressure and Temperature in the British Islands.—Fifteen years ago Dr. Buchan published papers on these meteorological elements in the *Journal of the Scottish Meteorological Society*. Since then many new and important stations have been added, and better records, and for longer periods, are now available, and therefore Dr. Buchan has returned to the subject in the latest number of the *Journal*, 3rd Series, Nos. xiii. and xiv. The observations from which the paper has been prepared extend over forty years, from January 1856 to December 1895. A few general results are given here.

The charts of isobars show that the mean annual pressure steadily diminishes from 29·993 inches on the Channel Isles to 29·771 at North Unst, Shetland, while still farther north-north-west it sinks to 29·751 inches in Faerö, and 29·661 at Stykkisholm, Iceland. The general direction of the isobaric lines is nearly from west-south-west to east-north-east. The most marked feature is the down-curving of the lines as they cross the Irish Sea and St. George's Channel, and the disturbance is greatest where this offshoot from the Atlantic is broadest and the adjoining portion of Great Britain narrowest. The same depressing influence of the ocean is also plainly seen in the dip of the isobars towards west-north-west, resulting from the position of Great Britain between the continent of Europe and the Atlantic. Less strongly marked, though quite distinct, is the influence of the land in increasing pressure. This is seen in the course of the lines over Scotland, which curve northwards over the central districts; and still more decidedly in the southern half of England, where, the breadth of the land being greater, the effect is more pronounced.

Similar deflections of the isobars occur in the monthly charts, the influence of

the land tending to lower the pressure slightly in the warmer months and increase it in the colder, while in all seasons the ocean lowers the pressure, especially near the coasts of the Atlantic and of the North Sea. Owing to the Mediterranean character of the Irish Sea, the deflections of the isobars as they cross it are very conspicuous, indicating in an impressive manner some of the more prominent causes which regulate the geographical distribution of atmospheric pressure over the globe.

Turning to the temperature charts, we find that the isothermals run on the whole east and west, showing that the sun is the predominating factor in the annual distribution of temperature. As a rule, also, the isothermal lines are equidistant, the greatest differences of interval being along the meridian of 4° W., which passes through those districts where the greatest contrasts in the distribution of land and water are to be found. These disturbances point to the influence of the ocean, which, next to that of the sun, most powerfully affects the British Islands. This influence, the prevailing winds being west-south-westerly, affects the temperature to a much greater degree on the west than on the east. While on the west the mean temperature of the sea is about 3° higher than that of the air, on the east it is 1°. Further, the prevailing winds over St. George's Channel and the Irish Sea assume a more southerly direction than elsewhere, causing a remarkable curving northwards of the isothermals over the coasts and islands of these seas.

But it is in winter that the beneficial influence of the ocean is most apparent, and it is more decided in proportion as the locality is surrounded by the warmer Atlantic waters. This point is well illustrated in Dove's map of Isabnormals of Temperature for January, from which it may be deduced that, but for the ameliorating influence of the Atlantic, the mean temperature of London in the middle of winter would be 22·0°, of Edinburgh 12·5°, and of Shetland 7·5°, so that the winter of London would resemble that of north-west Iceland and the winter of Edinburgh would rival in severity that of the south of Greenland.

If a winter climate be sought possessing, in the highest degree afforded by the British islands, the combined qualities of mildness and dryness, it will be found on the shores of the Channel from about Dover to Portland. To the west of Portland and round the coast to Clifton the temperature is higher, but the rainfall is greater and the climate damper. On the other hand, in the eastern counties north of the Thames the climate is as dry, or rather drier, but the temperature is 2° or 3° colder. All sanataria on the south and west coasts have, compared with inland places, the strong recommendation that during severe winters the fall below the average on the coast is about a third of the amount it attains inland.

The highest summer temperature occurs in the valley of the Thames around London, where many places have a July temperature of about 64°.

From its complete insular position the Isle of Man offers great advantages in the coolness of its summer and the mildness of its winter. Rothesay and other watering-places on the Clyde are similar in this respect, but the rainfall there is heavier than on the south coast and in the Isle of Man.

A third important element in determining temperature is elevation, the mean temperature falling at the rate of about one degree for every 270 feet. To this is due the great attraction of the summer climate in the Scottish highlands. In the upper districts of Deeside, Donside, and Speyside are the finest summer climates in the British islands, especially for those whose systems require bracing up. Other places at a height of 700 feet and upwards are comparatively wet.

For a complete representation of the climate of the British islands it is most desirable that additional stations should be established. Of still greater importance

would be a systematic observation of the sea temperature all round the coasts, and also the establishment of lines of stations from the coast inland, with a view to ascertaining how far the sea climate extends towards the interior.

ASIA.

Sannikof Land.—On a bright summer's day four mountains can be seen from the north end of Kotelnyi, New Siberia Islands, lat. 76° N., barely rising above the northern horizon. This is the, as yet, unexplored Sannikof Land, so named after Jacob Sannikof, who first descried it in 1805. The following year he saw a second land in a north-north-easterly direction from Cape Vysokii on New Siberia, the island he discovered. Twenty years later Lieutenant Anjou, who was commissioned to examine the lands discovered by Sannikof, came back convinced that no such lands existed. But De Long, who lost his ship, the *Jeannette*, in 1881, discovered Bennett Island in 77° 15′ N. lat. and 154° 39′ E. long., and thus Sannikof's report of land north-north-east of New Siberia was confirmed. In 1886 Baron von Toll saw four flat-topped mountains in a direction N. 14° to 18° east from the north-west end of Kotelnyi, closely resembling in form the basalt hills of the Sviatoi Noss. The distance from Kotelnyi, judged by the apparent height, would be about 100 miles, so that the south end of Sannikof Land lies between 77° and 78° N. lat. Bennett Island is also formed of trap, and it is not improbable that other undiscovered islands lie in the neighbourhood. Horns of reindeer were also found by De Long, and it is improbable that the animals came either from a large country to the north or from the Siberian mainland. Probably then they date from Post-Pliocene times, and the continent may then have extended far into the Arctic Ocean.

Baron von Toll has planned out an expedition to Sannikof Land. This summer or next he will send a vessel round Cape Cheliuskin to the mouth of the Lena, in which he will sail the following year to Sannikof Land, with dogs, reindeer, and perhaps some Yakut horses, and provisions for two years. On its return to the Lena the vessel will leave a depôt of provisions on Kotelnyi Island. The party on Sannikof Land will make excursions in all directions, if possible as far as Bennett Island, and, should the way be clear, will be taken off again in the summer of 1900 or 1901, and return to the Lena by the east side of the New Siberia Islands.—*Globus*, Bd. lxxiii. No. 23.

Baku.—As a harbour town Baku came into existence at the end of the fifth, or beginning of the sixth, century. It is mentioned by Arab writers of the tenth century, and the oldest existing monument in the town bears the date 471 of the Hejrah, corresponding to 1078 of our reckoning. Baku was an object of contention during the Middle Ages, belonging now to the Kalifs, now to the Persian Shahs, now to the Armenian kings, and often subject to Turkish rule. At the beginning of the eighteenth century it was in the hands of the Shah; in 1723 it was occupied by Peter the Great, but was restored to the Persians in 1735, and was not incorporated finally into the Russian Empire until 1806. It was then of little importance, containing only some 4000 inhabitants. When, however, Shemakha, the capital of the province, was destroyed by an earthquake in 1859, the inhabitants fled to Baku, which became the centre of administration. The extraction of petroleum has been the cause of its present prosperity; in 1879 the town had already 15,000 inhabitants. Now it consists of three quarters—the old Persian town, a labyrinth of narrow, dirty lanes grouped around the old palace of the Khans and the Virgin Tower; the new Russian town, with broad streets and

electric tramways ; and the town of the oil refineries, two miles to the east of Baku proper.

While in America the raw product from the bores is immediately conducted away by pipe lines and refined on the coast by other companies, at Baku the process of separating the different constituents of the oil is carried on on the spot. Though the raw product of the various oil-fields differs in composition, it in all cases consists of a mixture of hydrocarbons with different boiling-points, so that by successive distillations these hydrocarbons are vaporised one after another, and are thus separated. The petroleum of Baku yields (1) benzine and similar light hydrocarbons ; (2) burning oils of various kinds (kerosine or petroleum) ; (3) the so-called heavy oil, much prized for lubrication ; and (4) *masut*, a viscous residue, from which other substances, such as vaseline, are extracted, but which is chiefly valued as fuel. The lubricating oil is the most valuable. The raw petroleum of Baku yields 30 per cent. of paraffin, 10 of lubricating oil, and 60 of *masut*, whereas the Pennsylvania petroleum yields 85 per cent. of lamp oil. Ninety-eight per cent. of the Russian output comes from Baku, which in 1896 produced 6,082,000 tons, of which 1,102,500 tons were sent out from Nobel's works. The numerous products of distillation are forwarded almost exclusively by water. The cistern vessels of the firm of Nobel, containing nearly 10,000 tons each of oil and *masut*, ascend the Volga ; about 250 warehouses for oil are scattered over the whole Russian Empire.

The oil-fields in the neighbourhood of Baku are not extensive. About seven and a half miles north of the town lies the Balakhany field, about six square miles in area, and three and a half miles to the south Bibi-Eybat, about two square miles. On the Apsheron peninsula the conditions are far more favourable than in Pennsylvania, where the oil-bearing strata lie 2000 to 2600 feet below the surface. Here the bores are in general only 400 to 500 feet deep, and not till recently have they been carried down to 1300 to 1600 feet. 1600 derricks stand close together over the oil-fields, and since the extraction of oil was first commenced, 1650 borings have been executed, of which 917 are now in activity. When first tapped, the oil often shoots into the air, bringing with it brine sand and fragments of stone, but from most of the wells the oil has to be pumped out. Its temperature varies from 64° to 82° F., and it is easily set on fire, several hundred thousand pounds worth of oil having sometimes been lost in this way.

Gas vents and mud volcanoes are especially characteristic of Baku. At the coast of Bibi-Eybat carburetted hydrogen bubbles up to the surface of the water, and at Surakhany, nine miles north-east of Baku, petroleum oozes out of the ground, and near at hand the ground is pierced with a number of gas vents. Here is the old site of the holy fire of Baku, the Atesh-gah of the Hindus. Classical writers do not mention the fire of Baku, of which the earliest record is found in the works of the Arab writer Masudi, who lived about 1000 A.D. Many travellers at the end of the last and beginning of the present century speak of fire-worship at Baku, and it is reported that many Persian Guebres lived there about 1750. But in the celebrated Atesh-gah lived till a few years ago, not Parsees but Hindus, who sojourned some time here as monks or pilgrims, and had nothing in common with the followers of Zoroaster. The Atesh-gah, *i.e.* "place of fire," consisted of a space of ground surrounded by a high white wall, in the middle of which stood a temple, where the eternal fire burned. The last worshippers at the shrine are said to have sold the holy fire to a company. The temple fell in, but was restored in its original form on the occasion of a visit of Alexander II. to Baku, in 1888.

On the Kertch peninsula at the west end of the Caucasus, and at Baku at the

east end, mud volcanoes are very common, rising sometimes into cones 1000 feet high. They stand in rows parallel to the folds of the strata, and, like the petroleum reservoirs, lie along the anticlines.

The geological formation has been ascertained down to depths of 1000 to 2000 feet. All the rocks are sedimentary, and volcanic rocks are entirely absent. The whole series belongs to the Tertiary and Quaternary periods. The oldest deposits are grey clay-slates, with sandstone strata which contain large quantities of the bones of sharks. Then follows the petroleum-bearing formation, the Balakhany series, as much as 3300 feet thick, consisting of grey marl, chalky sandstones, and sand in thin strata, poor in fossils. The petroleum collects in the sand layers between the clay and the sandstone. These strata belong to the deposits of the wide sea which stretched in Oligocene times from the Atlantic eastwards. The most productive strata of the Balakhany series have a thickness of about 1600 feet. The higher the petroleum lies, the lighter it is. The Tertiary strata of Baku are upheaved in flattish undulations, having axes running from north-west to south-east, and, as before mentioned, it is in the anticlinal saddles that the petroleum, gaseous emanations, mud volcanoes, etc., occur. To this is due the comparatively small depth of the borings.

Tertiary sediments, similar to the petroleum strata of Baku, are found on both sides of the Caucasus. On the north side a petroleum field is worked near Groznaia ; a mud volcano on the Kertch peninsula has for ages produced hydrocarbons, and in the same direction westwards lie the Galician and other petroleum fields. Eastwards also on the island of Cheleken, south of Krasnovodsk, and on the mainland for a distance of 76 miles in a south-easterly direction, naphtha springs occur, while still farther east in the Turkoman steppe enormous quantities of petroleum are stored up for future generations.—Dr. Carl Schmidt in the *Geogr. Zeitschrift*, Heft 6.

The Early Commerce of Babylon with India.—In the *Journal of the Royal Asiatic Society* for April, Mr. J. Kennedy publishes an interesting paper with the above title. He holds that the existence of commerce between these countries is in particular evidenced by the Brahman alphabet and the *purānas*, the most ancient coins of India. Three trade routes between Western Asia and India are possible. The route across the Zagros range was barred for centuries by the hostility of the mountaineers, until the "Great King" reduced the Kurdish mountaineers. Along the second, which traverses the mountains of Armenia to the Caspian and the Oxus, and descends into India by the passes of the Hindu Kush, articles of commerce doubtless passed from early times, but only in small quantities and intermittently, until the Parthian domination forced trade into this channel. There remains, then, the sea, and maritime intercourse by this highway arose, Mr. Kennedy maintains, not in the remotest ages, as generally assumed, but at the commencement of the seventh century B.C. He sets himself to prove (1) that the early commerce of the Egyptians, Babylonians, and Arabs, in the Eastern seas, did not embrace India ; (2) that, as shown by the history of the Chinese coinage, an active sea-trade sprang up about 700 B.C. between Babylon and the East, in which India had a considerable share ; (3) that these facts have an important bearing on the history of Indian letters and coinage ; and (4) that certain features of Indian art, which cannot be due to the intervention of Persia, and which are probably not indigenous, may be explained as traces and survivals of Babylonian influence.

AFRICA.

Progress of the Congo State.—Mr. Pickersgill, British Consul in the Congo State, has made a report, which was issued on June 8th. One great obstacle that the administration has had to contend with, transport from Matadi to Stanley Pool, has been removed by the Congo railway, and henceforth machinery will be easily conveyed to the upper part of the river. But its effect on the hinterland savage must be very limited, and it will be long ere the native will consent to be hustled through life by the restless European. On the Congo the difficulty of controlling the natives is much increased by the absence of a common language. Kicongo, spoken throughout what was once an important kingdom, with its capital at San Salvador, and which has been reduced to a written language, ceases to be generally understood before Stanley Pool is reached. Farther east the tongues are almost as numerous as the waterways, and a knowledge of one of them is perfectly useless for communication with another tribe. The huge and complicated system of the Congo and its labyrinthine tributaries enables the native at any moment to place all his belongings in a canoe, and escape the supervision of the Belgian official. A more difficult country in which to control scattered communities than the thousand miles between Leopoldville and Stanley Falls cannot be imagined. The unhealthiness of the country constitutes a very evident impediment, but perhaps its full significance is not generally appreciated. Out of ten European officials, nine die or are invalided within three years, and it has been found that the employés of a Belgian company, numbering 120, serve on an average only seven months out of the twenty-four for which they contract. Nevertheless, the traveller on the Congo is struck with the tokens of successful effort he meets with, especially in geographical research. Much exploration remains to be carried out, but, on the whole, the official knowledge of the country is marvellous, considering that the State has been established only a dozen years.

Equatorial Africa is not a white man's country, and therefore the all-important question is, to what extent has the Congo Government promoted the welfare of the native? Mr. Pickersgill points to six modes in which the activity of the State has been exercised for good, though in some directions there is still much to be done. The liquor traffic has been restricted to the lower river, where it already flourished when occupation took place. Cannibalism has diminished, many tribes being now ashamed of the practice, and intertribal wars have been suppressed over a wide area. The yoke of the Arab slave-traders has been broken, and traffic in human beings among the natives themselves has been greatly restricted. The natives are being drilled into regular work, and where the missionaries have gained the confidence of the people, the employment of local carriers has become feasible. Lastly, the Government has disbursed £6000 per annum on an average for the purposes of education. But the movement has been really successful only in the case of waifs and strays picked up by exploring parties and military expeditions. Here, again, the confusion of tongues causes so many difficulties that the Protestant missionaries prefer to devote themselves to their own parishioners instead of sharing in the work.

While the Government deserves all credit for the efforts it has made to extend civilisation, its vexatious taxation must be placed on the other side of the account. A new settler on the Upper Congo must pay for a licence before he can engage porters, and a tax on every load. A steamer is taxed, and a rowing-boat, and dead wood cannot be taken from the forest without a licence. A plot of ground for a house must be leased from the Government; the timber to build the house is taxed though the settler fells it himself, and the house and every separate out-

building, hut, shed, hen-house, and sheepcote pays its separate duty. The settler must also pay a tax for the workmen he employs, whether native or imported. In short, as the British and American missionaries told Mr. Pickersgill, there is nothing free in the Independent Congo State except fevers. A Belgian Father remarked: "The Government taxes even the civilisation we bring."—*The Scotsman*, June 9th.

AMERICA.

The River Kuskokwim.—This, the most important river of Alaska after the Yukon, is 800 miles long, and enters the great bay of the same name some two degrees north of the Aleutian peninsula. At its mouth it is so wide that the shores are invisible from mid-channel, and it is navigable by barges for a distance of 500 miles. The tide rises fifty feet, and when it runs out a vast area of oozy mud-flats is exposed, sixty miles wide at the mouth of the river. The tide ascends the river 100 miles, to the trading-post called Mumtrekhlagamute. It rushes up with a force which even steamboats cannot contend against, rising over eight feet in an hour, and filling the vast bed in the brief space of six hours, though there is nothing of the nature of a bore. There are no fewer than sixteen trading-posts and villages within the first 400 miles from the mouth, and as long ago as 1885 Messrs. Hartmann and Weinland, two Moravian missionaries, founded a station at Kolmakovsky, 200 miles up. When they arrived in June at the mouth of the river the salmon fishery was at its height, and the resident Eskimo, several thousands in number, were reinforced by accessions from the Yukon to a total of seven or eight thousand. There is a portage of sixty miles between the Yukon and Kuskokwim which has been travelled for a century by employés of the Russian Fur Company and others. Besides large salmon, there is abundance of grayling and so-called salmon trout.

The missionaries ascended the river in *bidarkas*, sealskin canoes decked over and with three man-holes, the middle of which is occupied by the passenger. After passing several native villages they came to a narrower part of the river, where the opposite bank was clearly visible, and presently the channel was divided by numerous islands. The shores were lined with a higher growth of underwood, and thickets of small birch-trees alternated with grassy or mossy banks. Ranges of snow-covered mountains came into sight the day before the missionaries reached Kolmakovsky. The journey from the mouth of the river occupied twenty-one days, while down-stream it is accomplished in nine. On reaching the sea the missionaries followed the indentations of the coast to Good News Bay, and then taking a canoe route across the neck of a mountainous headland, avoided a perilous sea voyage on their way to their destination at Togiak Bay. Poling up a winding mountain stream, beautifully clear and very rapid, they made a portage across the divide and entered a chain of lakes drained by the stream they wished to descend. The lakes, four in number, are very small, the largest being scarcely a mile long, and are full of "red salmon," probably the *Salvelinus malma* or Dolly Varden. One characteristic of this fish is a large swelling on the back close to the neck.—*The National Geographic Magazine*, No. 3.

Origin of the Cliff Dwellings in America.—Though a cliff ruin was described by Lieut. Simpson as long ago as 1850, practically nothing was known of these erections until about twenty years ago, when they were brought to the attention of the public by the explorations of the Hayden Survey in Colorado and Arizona. They were at first supposed to be the work of a distinct race, in some way allied to the

Aztecs of Mexico, and to have been the houses of a remnant of the people left behind in a great migratory movement to the south. When, however, the cliff ruins came to be studied under the auspices of the Smithsonian Institution, some fifteen years ago, it was soon discovered that the ruins and the inhabited villages of the Pueblo Indians pertained to the said people, but it was supposed that they were the result of exceptional causes, that they marked an early period of Pueblo Indian culture, or that they were defensive structures resorted to by the tribes when the attacks of their enemies compelled them to abandon for a time their usual habitations.

Mr. Cosmos Mindeleff, on the other hand, holds that they belong to no particular period in culture or in time, though many of them are undoubtedly very old, but that they are due to a peculiar topographical environment. The country in which they are found extends from the Colorado cañon to the Rio Grande valley, and from Salt Lake city to beyond the southern boundary of the United States. Within its area of 150,000 square miles there are thirty inhabited villages, and thousands upon thousands of ruins. The dominant topographical form is the mesa, and these mesas are everywhere cut and seamed by cañons, varying in breadth from mere gorges to ten or even twenty miles. The walls are usually composed of vertical cliffs, 10, 20, or 100 feet high, connected by long slopes of *débris*, and the bottoms of the cañons are, as a rule, flat, and covered with rich alluvial earth, brought down from above by floods. It is in these walls that the cliff ruins occur, and they were always placed so as to overlook some area of good bottom land which was under cultivation. The edges of the mesas and the walls of the cañons furnish an inexhaustible supply of good building stone, often of the proper form for masonry, and it required as a rule less work to build a house in the cliffs than elsewhere.

The Pueblo Indians are an agricultural people, and the country being within the arid region, the cultivable areas are often small in size, and few and far between. Thus the people often live at some distance from their fields, and as they cannot go backwards and forwards each day, they put up temporary shelters in the fields, which they occupy till the harvest is over. The same practice seems to have prevailed in ancient times. Nine-tenths of the cliff ruins are single rooms or small clusters of rooms, overlooking the valley bottom, and the home villages are to be found not far away. In the De Chelly cañon, in north-eastern Arizona, the ruins are more numerous where they command views over larger areas of cultivable land, and where the talus blots out the bottom lands they are entirely absent. Another feature of these temporary residences is that they contain no *kivas* or *estufas*. These are circular chambers, partially or entirely underground, and entered by a trap-door in the roof, in which all the religious and civil business of the tribe is transacted. By this criterion it may be decided that nine-tenths of the buildings in the De Chelly cañon were farming outlooks. That this was the real origin of the cliff dwellings, and that they were partly due to geographic environment, is shown by their absence in the Rio Grande valley, the home of the Pueblos, where the geologic formations are not favourable to them, while in the valley of the Rio Verde in Arizona their place is supplied by caves excavated in the rock, which is exceedingly soft.—*Bull. of the American Geogr. Soc.*, vol. xxx. No. 2.

Paraguana.—The peninsula thus named, which juts out from the mainland of Venezuela, on the western side of the Gulf of Venezuela, was explored in 1886 to 1888 by Richard Ludwig. In 1894 Ludwig died at La Guaira, and from his journals Dr. W. Sievers has culled some geographical and

geological notes, which are published in *Globus*, Bd. lxxiii. No. 19. It appears that Paraguana is closely connected with the Sierra Nevada de Santa Marta in its structure, as Dr. Sievers conjectured long ago. It may be divided into two geographical sections—the lower lands of the peninsula, and the high steep Cerro de Santa Ana, with its eastern spurs, the group of Tausabana and El Rodeo, and the mountains of Arajó on the west. The former, except where quite recent formations occur on the coast, consist of Tertiary ridges on an archæan base, the latter exclusively of old eruptive rocks. West of Pueblo Nuevo, Ludwig found granites resembling those observed by Dr. Sievers at the Montaña de Azaro. There is also a considerable variety of sedimentary rocks—slates, quartz sandstone, limestone, siliceous schists, etc. Ludwig further mentions a bluish-grey crystalline limestone as occurring at Montecan and Plantacio, and hälleflinta appears at the north-west foot of the Cerro de Santa Ana, on the border of the eruptive rocks. Probably the granite foundation extends over the whole peninsula, as it crops out at two points on the northern side of the hills, between Buenavista and Pueblo Nuevo.

It is questionable whether there has been a covering of archæan schists. No reliable information has been obtained respecting the age of the quartzite, schists, and limestone, which may date from the Cretaceous period, especially as hitherto no formations have been found in Venezuela but the Cretaceous and Tertiary.

The eruptive rocks cover a large area in the south of Paraguana. They have apparently burst out of a narrow fissure, and now they form steep cliffs about 2900 feet high. Possibly they were ejected in Cretaceous times, but it is also not improbable that they form an integral part of an archæan range of schists, not easily distinguished in other parts of Paraguana, but conspicuous on the islands of Curaçao and Aruba, and probably also on Roques and Orchila. They may also be traced westwards, for they probably form the domes of Goajira, and certainly a great part of the Sierra Nevada de Santa Marta, where there is also a granite foundation. In fact, Paraguana has almost a closer relation to the Sierra than to Aruba.

The Upper Amazon.—In 1894 Dr. A. Rimbach made a journey into the Ecuador territory east of the Andes, a country that is still waiting to be thoroughly explored. He set out on his journey from Riobamba on January 19th, and the day after reached the deep cleft in the eastern cordillera at the foot of Tunguragua, where join the Chambo, which drains the Riobamba basin, and the Patate coming from the north. The united stream, under the name of Pastaza, immediately flows eastwards into the gorge. At the village Baños, on the south bank of the river, and just at the foot of Tunguragua, the people were much excited about the boundary question. Ecuador wishes to draw the boundary line along the Marañon from the mouth of the Santiago to that of the Napo, while Peru claims all the country north of the Marañon up to the cordillera. A compromise, accepted by the plenipotentiaries of both States, by which the lower courses of the rivers from the Pastaza to the Napo was to be ceded to the Peruvians, had just been rejected by the Peruvian Congress, and hence the excitement among the Ecuadorians.

Soon after leaving Baños a marked change in the vegetation was apparent ; the characteristic plants of the sierra were left behind and the country was wooded. Juicy herbs and clumps of a bamboo-like grass edged the path, and moss and ferns grew in the shadow of the trees. A large number of brooks and rivers join the Pastaza, most of them falling from the edge of a small plateau filling up the end of the side valley. These plateaus furnish sites for settlements ; much of the wood on them has been cleared, and sugar-cane plantations surround the huts, in

which there is generally a crushing mill and a primitive still. One of the largest rivers is the Rio Verde, the crystal water of which flows through a very Paradise. The whole valley of the Pastaza, being 3900 to 4900 feet above sea-level, has an exceedingly agreeable climate and is full of variety. The settlements come to an end above the Rio Topo, one of the largest affluents of the Pastaza. This river has a very rocky bed, and is very rapid. The route to Canelos is seldom trodden, and the path is in many parts quite unrecognisable. After descending to an elevation of 3600 feet, Dr. Rimbach had to climb the Abitahua, a granite ridge about 5900 feet high. It was thickly clothed with wax palms, many of which had fallen and lay in wild confusion on the ground. Soon after crossing the Abitahua the party left the Pastaza, which turned to the south-east, in order to continue their easterly direction. The vegetation assumed the character of damp tropical lands, and large trees 130 feet high became numerous. Among them was the stately copal, with masses of resin hanging on its stems, which the natives use in rainy weather to light fires. After travelling a week through the gloomy forest, always wet with the constant rain, Dr. Rimbach crossed a ridge, where in contrast to the country just passed through the wood was full of lianas, to the valley of the Tinguisa river, and followed it to its confluence with the Bobonaza, where stands the village and mission of Canelos.

The mission stands on a ridge of hills, between 3000 and 3200 feet above sea-level, and is surrounded with fields of sugar-cane, bananas, yucca, coffee, etc. The temperature ranged from 64° to 84° F. Thunderstorms occurred frequently, and at all times of the day, especially in the morning, when they were accompanied by violent squalls. In the forest lie scattered the huts of the six hundred Indians who constitute the villagers of Canelos. Like all Indian huts in the Marañon basin those at Canelos are rectangular, roomy, and thatched with palm leaves. At the time of Dr. Rimbach's visit they were empty, for, besides his usual dwelling, every Indian owns a plantation and hut, several days' journey distant, to which he migrates every year with his family in order to harvest the yucca (manioc) and hunt.

Dr. Rimbach and his party descended the river in a dug-out, passing the settlements of Pacayacu and Sarayacu. The Bobonaza runs on the whole east-south-east. A voyage of five days brought the traveller to the Pastaza. The village Andoas, near the confluence, is now nearly deserted on account of its unhealthiness, and because the Indians are sent by the Peruvian indiarubber dealers into various districts to collect caoutchouc. The temperature during three days in May ranged from 70° to 80½° F. The voyage down the river was neither safe nor pleasant owing to floods which caused the river to spread far beyond its banks, and swept along trunks of trees. The general direction of the Pastaza from Andoas to the mouth is from north to south, with a slight deviation towards the east, and its course has few bends.

On reaching the Marañon Dr. Rimbach turned down stream to S. Lorenzo, near the mouth of the Huallaga, where he waited until the Amazon steamer *Bermudez* returned from Yurimaguas. The temperature at S. Lorenzo at the end of May varied from 68° to 84° F., and in the surface water of the river it was 76°. The river was much swollen and carried down a large quantity of driftwood. The high water usually lasts from February to May; from June to September the water sinks to its lowest level, and then rises somewhat in October and November. Sugar chiefly is grown at S. Lorenzo, most of it for distillation.

On the return of the steamer Dr. Rimbach took passage in it for Parinari, an Indian village on the northern bank, where are a sugar-cane estate and distillery. The products are sold in Iquitos, as also bricks and tiles made of the clay from the banks mixed with the sand of the river. From this place Dr. Rimbach made an

excursion to the small river Samiria, where animal and vegetable life was extremely abundant. Here he saw the *Victoria regia* for the first time, and specimens of the *Arapaima gigas*, six and a half feet long, were harpooned. The manatee is also common. A steamer having unexpectedly arrived at Parinari, Dr. Rimbach and his companion travelled in it to Yurimaguas, and then ascended the Paranapura to Balzapuerto and crossed over to Moyobamba. On August 21st they came to Chachapoyas, a town lying in the deep, narrow valley of the Utucamba at a height of 7500 feet. Here they were informed that the country to the north was infested by bands of insurgents, and therefore they were obliged to make for the Atlantic coast, which they reached by Leimebamba and Cajamarca.

Dr. Rimbach's explorations and inquiries show that Dr. T. Wolf's mapping of the rivers on the Amazon slope of Ecuador is on the whole correct. The left-hand tributaries in the lower course of the Pastaza shown on Dr. Wolf's map do not exist, the sources of the Nucuray and Chambira lying close to the Pastaza. The latter rises near to Andoas.

The Climatic Control of Occupation in Chile.—Mr. R. De C. Ward contributes an article with this title to the *Journal of School Geography*, December. The key to the climatic contrasts of Chile is to be found in the presence along its eastern border of the great chain of the Andes. In the trade-wind latitudes on the western or leeward coast of South America we find the dry and barren regions of Peru and Chile. From lat. 4° S. as far as about lat. 30° S. the western coastal strip is almost rainless. But south of lat. 30° S. commences the region of prevailing westerly winds, and consequently the rainfall increases until at lat. 38° S. we enter a zone of heavy rainfall. On the eastern side of the cordillera, on the other hand, the fall decreases from 30° southwards. As on the Pacific coast of the United States the rainfall decreases rapidly from north to south, so in Chile it decreases from south to north, that is, in both cases towards the Equator. At Ancud on the island of Chiloe the mean annual fall is between 100 and 125 inches ; at Valparaiso between 10 and 20 inches ; and at Copiapo less than half an inch. Naturally, in the northern provinces of Chile agriculture on a large scale is impossible, as vegetation can flourish only in irrigated lands of small extent. Mining is, therefore, the only occupation of importance. In Southern Chile, up to lat. 41° S., the abundant rainfall has covered the ground with dense forests, and at present, at any rate, lumbering and fishing are the chief occupations. Between these two lies the agricultural district of Chile, between lat. 27° and 41° S.

Other factors besides climate must, of course, play a part in determining the occupations of men, as, for instance, the geological formation.

GENERAL.

The Invention of the Compass.—At the third Italian Geographical Congress, Col. A. Botto communicated some interesting notices he had collected from various writers on the loadstone (called *Magnes*, according to Nicander, from the Lydian shepherd who first discovered its power of attraction), which bridged over the interval between the descriptions of Plato, Pliny, and Lucretius, of the attractive properties of magnetic iron, and the introduction of the needle as an instrument of navigation. Augustine of Hippo, in his *De Civitate Dei*, mentions the power of the loadstone not only to attract a piece of iron, but to render it also magnetic, and adds that his brother bishop, Severus Milevitanus, had seen a piece of iron on a plate of silver follow rapidly the movements of a magnetic needle held underneath. Rufinus of Aquileia also (345-410 A.D.) states in his

history that in the temple of Serapis at Alexandria was an image of the sun, made of a very thin sheet of iron, which was held suspended in the air by loadstones suitably arranged in the walls, while in the same period a physician of Theodosius the Great declares that the magnet can repel as well as attract iron. It would seem that the needle mentioned by Augustine must have been set on a pivot, or it could not have followed freely the movement of the magnet below. The earliest author, however, who describes a balanced compass-needle is Alexander Neckham (1157—1217), an Augustine monk of St. Alban's, who states that the needle turns towards the north, and that sailors can by this property find their way in the darkness of night, or when the sun is obscured by clouds.

From the seventh century the citizens of Amalfi were the principal traders with the East, being favoured by the Saracens. Consequently they would have abundant opportunities of obtaining magnetic iron from the country of its origin. Guglielmo Pugliese, between 1087 and 1099, wrote a historical poem, *De Rebus Normannorum*, in which occurs the sentence, *ac plurimus urbe* (Amalfi) *moratur nauta, maris coelique vias aperire peritus*, which has always been held by writers on the history of the compass to refer to that instrument. Certainly in 1269, when Pietro Peregrino de Maricourt wrote his *Epistola de Magnete*, the Italian pilots already possessed *portulani* of the Mediterranean, with winds (*i.e.* directions) and distances drawn with the aid of a compass balanced on a point.

Professor Klaproth, endeavouring to prove that the Chinese were acquainted much earlier than Europeans with the nautical compass, and probably made use of it, ended by declaring that the earliest mention he could find of a floating compass in Chinese encyclopædias dated back to between 1111 and 1117. Nicolo de Conti, a Venetian, who travelled for twenty years in India during the first half of the fifteenth century, and a Florentine who came back from India with Vasco da Gama, both declare that compasses were unknown in the Indian Ocean, and it is not till the middle of the sixteenth century that a traveller, Ludovico Barthema of Bologna, first speaks of them as being in use in the East.

Movements of the Earth's Crust.—In the *Journal of Geology*, vol. vi. No. 1, Major J. W. Powell propounds a new theory to account for the movements of the Earth's crust. After describing the character of these movements, he affirms that geologists have as yet found no law that satisfactorily accounts for them. The hypothesis of a cooling and contracting Earth has been found inadequate. When this hypothesis was first considered, flexion seemed to be the chief method of displacement, whereas it is now known that fracturing and faulting are the most common effects in regions of maximum action. Inclined rocks seem to have been stretched, as evidenced by the elongation of particles transverse to the strike, and they seem further to have been stretched by the opening of fissures and joints. Altogether, the contraction does not appear, to Major Powell, to have been sufficient to produce the results observed, nor to explain the concomitant phenomena. With the above hypothesis another is associated, that the centrosphere of the Earth is metallic. Of this no evidence has been obtained, but the stupendous fact remains that the centrosphere has more than twice the density of the crust. It is found by experiment that metallic and other substances flow under pressure, and rocks are deformed under differential pressures, being twisted, contorted, and kneaded into new shapes. Finally, there is abundant geological evidence to show that faulting at the surface appears as flexure at greater depths, and that at still greater depths the flexure takes the form of molecular readjustment.

Assuming, then, that all rocks flow under pressure, that the critical point is variable, and that the modulus of compression is also variable, being greater for

the lighter rocks and less for the heavier, and that this modulus is greatly accelerated at the critical point, Major Powell believes that he has found a law which will account for all the facts of geonomy as completely as the law of gravity explains astronomical facts. The reassumption of constitutional structure in crystallisation and glassy lithification necessitates expansion, which produces upheaval. When lands rise and are denuded, relithification in the centrosphere continues upheaval, and the process goes on until equilibrium is reached, when the land is reduced to the level of the sea by degradation. On the other hand, as land is loaded, the subjacent rocks are brought within the zone of accelerated compression, and this process ceases when the land from which the detritus is taken is brought down to the level of the sea.

Universal contraction by cooling must still be postulated as an agent for the disturbance of equilibrium, unless the cause may be found in astronomical conditions.

MISCELLANEOUS.

Dr. Lauterbach's expedition has proved the identity of the Ottilien river with the **Ramu**. The steamer *Johann Albrecht* has ascended the Ottilien for 125 miles, up to the point where Dr. Lauterbach turned back after descending the Ramu for 155 miles (*see* vol. xiii. p. 212). The river, therefore, affords an excellent waterway into the interior, which will be of great service in future exploration.—*Petermanns Mitt.*, Bd. xliv. No. 5.

Mr. Walter Wellman, the American explorer, left Tromsö on June 27th for Franz Josef Land. He is accompanied by Prof. J. H. Gore, of the Columbia University, Lieut. Evelyn B. Baldwin, Dr. Edward Hofma, and Mr. Quirof Harlan of the U.S. Coast and Geodetic Survey. Mr Wellman and his party will advance northwards from Cape Flora past the spot where Nansen wintered, and Cape Fligely, and will build a hut to winter in at about lat. 82° N. In the spring he intends to make for the North Pole, and if the conditions are unfavourable, he will wait till the following spring.

Mr. Robert Smith, of Dundee University College, has contributed to the *Proc. of the Perthshire Society of Natural Science* a paper on the **Plant Associations of the Tay Basin.** He treats, first, of the "social" species, of which the individuals are so plentiful as to dominate over the other plants of the same area, and these he divides into twelve groups. Each of these he examines in detail, and also points out how certain species tend to exclude others from their neighbourhood. In the last chapter he enumerates the large and well-defined associations in each of the districts, alpine, sub-alpine, lowland, and littoral, on which Dr. Buchanan White based his natural sub-division of Perthshire.

M. de Bondy, French Vice-Consul at Formosa, writes that the **Bonin Islands** have recently been visited by some engineers. The inhabitants have been doubled in number within the last ten years. They cultivate sugar-cane and breed cattle, but neglect the valuable fisheries. The aborigines, of Malay race, are complete savages and dwell in caves; the Japanese immigrants till the soil and engage in commerce. The other inhabitants are Asiatic half-breeds, Chinese, Tagals, Koreans, and a numerous group of Europeans of all nationalities, forming an independent colony. These last are for the most part outcasts, who have been attracted by the absence of all official control and a fine climate. They are on a friendly footing with the natives, and often marry women of the country. The Japanese Government pays a subvention to one of their steamer lines, on the condition that its

vessels shall call six times a year at the Bonins, and a monthly service is proposed. This innovation will no doubt be an advantage to the trade and industry of the island, but will probably not be appreciated by the Europeans.—*Comptes Rendus*, No. 1.

At the International Geographical Congress in London, Professor Elisée Reclus made a proposal for the construction of a great globe on the scale 1 : 1,000,000 (see vol. xi. p. 474). On June 27th he treated of the same subject in a paper read before the Royal Geographical Society. Though much ingenuity had been exercised by mathematicians in reducing the errors necessarily accompanying the representation of parts of the Earth's surface on maps, Prof. Reclus maintained that these could never be satisfactory. Curves must be translated by curves, and a sphere, or fragment of a sphere, must be reproduced on a spherical surface. On small globes it is impossible to represent the forms of relief, and on no globes with a scale of less than one-millionth can the inequalities of the surface be reproduced in their true proportions, and an exaggeration of the vertical scale is condemned by Prof. Reclus as giving a false idea of surface configuration. Even on a scale of one-millionth, great masses of highlands and mountains 3000 feet in height will hardly stand out above the plains. If, however, a scale of 1 : 100,000 be taken, hills of only 150 feet in height may be clearly delineated.

NEW BOOKS.

Handbuch der Klimatologie. Von Julius Hann. 2^te^ wesentlich umgearbeitete und vermehrte Auflage. Pp. xii + 404; viii + 384; viii + 576. Stuttgart: Engelhorn, 1897.

For the past fifteen years every one concerned with climatic questions has kept on his reference shelf Hann's *Handbuch der Klimatologie*. These fifteen years have seen a great advance in meteorological work over all the world. The leading factors of the climates of the chief civilised states have been determined with greater precision. Definite figures have been obtained for the temperature, pressure, wind, and rainfall of many regions which have been opened up during this period; and although in many cases the figures are based on too short observation periods to be satisfactory, still they give a much more precise idea of the climatic characteristics than any merely verbal qualitative description. These figures are found scattered in many publications, often not easily accessible, and it is a great gain to have their chief results gathered together in one book and critically discussed by an authority such as Professor Hann. It is not astonishing to find that his second edition of the *Klimatologie* has nearly 600 more pages than the first edition, and that it is virtually a new book, which no geographer, which no one concerned with climatic facts and problems, can do without.

In reviewing a great work like this by one of the foremost climatologists, it is best to give a brief outline of its contents.

The present edition is a book in three volumes.

The first volume discusses general problems in a masterly fashion. It deals with the separate factors of climate, the solar climate as determined by the solar radiations reaching its different parallels of latitude at different seasons, then the modifications due, first, to the distribution of water and land, and secondly, to the irregularities in the surface of the land. This volume ends with a discussion of

climatic variations, and deals with the Ice Age and existing secular climate changes.

The second volume discusses the climate of inter-tropical regions, and this section is more than double the size of the corresponding one in the first edition. The tropics have become of great importance to Europeans in the past decade and a half, and our interests in these regions are rapidly increasing. For their profitable exploitation a thorough study of the climate is essential, and this volume of Professor Hann's book should be carefully perused by every one interested in tropical ventures—missionary, scientific, and commercial. Many a strenuous, useful missionary life has been unnecessarily sacrificed in these regions through ignorance of the climatic conditions.

The last volume discusses the climates of temperate and polar regions; and is an invaluable critical guide to the subject, whose vast literature is admirably summarised.

Professor Hann's book is essentially a handbook, full of condensed information, with adequate references to the sources from which it is derived, where fuller details can be obtained. The descriptions are guided by sound general views, which prevent the various paragraphs from being merely uncoördinated masses of information. Even in the general section, the speculative element is reduced to a minimum, and occasionally one would like to hear more of the author's own views on controverted questions. After using the book constantly for several weeks, one does not know whether to admire most the immense learning it reveals, or the skill with which this has been subordinated to a clear account of the climates of the world. Among indispensable books, this is one of the most indispensable.

Grundzüge der Pflanzenverbreitung in den Karpathen. By Dr. F. Pax of Breslau. 9 Figures in the text, 3 Engravings, and 1 Map. Leipzig: Wilhelm Engelmann, 1898. Pp. viii + 269.

This monograph on the "Outlines of Plant Distribution in the Carpathians" is the second of a series on the Vegetation of the Earth now being prepared under the editorship of Professors Engler and Drude. The first, which appeared in 1896, was by the late Professor Moritz Willkomm, and treated of the Plant Geography of Spain. Number three is already announced, and will deal with the Caucasus region, by Dr. G. Radde of Tiflis.

This series aims at a description of the plant covering of the Earth by specialists on each region, all following a uniform method in their treatment of the subject. It may be looked upon as a recast and extension of Grisebach's great work bearing the same title, *Die Vegetation der Erde*, 1872. Like Grisebach, the authors of the present series regard the description of the plant associations ("Pflanzenformationen") to be of primary importance in the delineation of the vegetation of a country. It is recognised that only a comparatively few species occupy the greater part of the surface of a country. These are the social-living trees, shrubs, grasses, etc., whose individuals are so numerous and often grow so closely together, that other species on the same area are quite subordinate to them or dependent upon them. Each of these social plants creates a particular environment for its subordinate species; thus we can distinguish between plants of a beech wood and plants of a pine wood, plants of the forest and plants of the grass meadow, plants of the heath and plants of the reed marshes, and so on. Each of these groups constitutes a definite plant association whose distribution is closely linked with the distribution of its chief species. The chief species in its turn

depends for its position on optimum conditions of climate and soil, without which its importance greatly diminishes. In this way the distribution of plant associations furnishes an excellent guide to the distribution of climatic and other geographical conditions.

In the present volume Dr. Pax arranges the plant associations into three groups according to the elevation at which they occur, as follows :—(1) those of the lower hills ; (2) those of the mountains up to the tree limits ; and (3) those above the tree limits. The tree associations are of great importance to the geographer. In the lower hills of the Carpathians the social or forest-forming trees are the same as those of Britain, viz., beech, mixed wood chiefly oak, Scots pine, birch, and alder. The life-conditions and construction of each association are carefully discussed, thus allowing of easy comparison with similar communities in Britain or elsewhere. In the higher Carpathians beech and spruce are the dominating trees.

Other parts of Dr. Pax's work still require consideration. The book opens with a historical review of botanical research in the Carpathians ; thirty-seven pages are occupied by a bibliographical list alone.

Part I. is devoted to the physical geography and climatology of the region. The connection between these and the botany is not very clearly brought out, and the use of this part is chiefly as a place of reference with regard to localities whilst reading succeeding chapters.

In Part II. the plant associations are dealt with. The last chapter of this part discusses man's influence on the vegetation, and that from three points of view :—(1) destruction of the forests ; (2) introduction of field plants ; and (3) spread of agriculture. Disforesting here, as elsewhere, has been the result of the spread of agriculture and of pasturing, and is attended with the usual calamities of soil denudation and flooding. However, a considerable amount of primitive forest still remains, especially in some magnificent stretches of tree-clad mountains in the eastern districts.

In Part III. the author seeks to determine the chief lines of vegetation in the Carpathians, to specify the endemic forms, and to indicate the natural subdivisions of the area. The chief vegetation-lines run in a general way from north-east to south-west, separating the western European flora from those of Russia and Asia. This is not as in the Pyrenees, Alps, and Balkans, where the lines run east and west, separating the mid-European flora from that of the Mediterranean.

The relations of the Carpathian flora to other floras are considered in Part IV. The strongest affinities are with the mid-European and the European-Siberian floras ; the Alpine region has, however, both Arctic and Alpine elements well represented.

The volume closes with a sketch of the development of the flora from the Tertiary period.

The work must prove a valuable contribution to our knowledge of that comparatively unknown district. Any criticism we make can only be on details in the method of presenting the facts. A want is felt of tabular arrangement of statistics, such as the altitudes at which the various regions of vegetation cease. Long lists of species are mentioned in the text, without variation of type or of arrangement in columns, thus rendering it difficult to see quickly if any particular species is present in a group. A map coloured to show at a glance the chief districts into which the region is divided would have greatly aided the comprehension of the text. The map which is given is clear and pleasing, although its explanation must be sought through eight pages of text. The book is well indexed, and all praise must be given for the beauty of the three photo-engravings which illustrate the work.

Through the Goldfields of Alaska to Bering Straits. By HARRY DE WINDT, F.R.G.S. London: Chatto and Windus, 1898. Pp. 312. *Price* 16*s.*

Those of our readers who heard Mr. de Windt's interesting lecture on his journey through the Yukon district will welcome the volume which gives in detail the story of his wanderings from the town of Juneau over the dreaded Chilkoot pass, thence to Klondike, and on to Fort St. Michael on Bering Straits. We may remark at once that no better description of the dangers and troubles which beset the goldseeker who goes to Klondike has ever come within our notice. The dangers by land and water read as if unsurmountable, and are, or at least should be, sufficient to deter any but men gifted with unusual physique from attempting to acquire a fortune in Klondike. On the other hand, these dangers and difficulties have repeatedly been faced and surmounted, and the story of Mr. de Windt's success in tackling them is told in a graphic and simple way, which impresses the reader with its truthfulness, and inspires him with admiration for the courage and perseverance of the intrepid explorer and his companions, who had no intention of seeking for gold as a reward for their pains. The book ought to be most carefully studied by all who contemplate a journey to Klondike, and by those who have friends who have gone there. It gives much useful information as to what to take and what to leave behind in the way of outfit. It conceals nothing of the hardships of the lot of those who reach Klondike, and it enumerates instances of success achieved and of fortunes made which explain and justify the enthusiasm and excitement with which the very name of Klondike is now universally associated.

Mr. de Windt's object was to go by land from New York to Paris, so, after reaching Klondike, he followed the Yukon to Bering Straits, and thence crossed over to Oumwaidjík in Eastern Siberia, the *ultima thule* of Asia. There he passed some months with the Tchuktchis, under the protection of their chief Koari, who turned out a consummate scoundrel. Mr. de Windt says of him: "I have never met his equal for cruelty, cunning, and duplicity, characteristics rendered the more deadly by the fine intellectual face and frank genial manner that masked them." His enforced residence at Oumwaidjík enabled Mr. de Windt to note the character and customs of a people of whom comparatively little was known. They are divided into two tribes, viz., the Coast Tchuktchis, who live by hunting and fishing, and number about 2000; and the Reindeer Tchuktchis, who dwell inland, live on reindeer, and number from 3000 to 10,000. They are the filthiest, as well as the bravest, race in that part of the world, levy tribute on their neighbours, and defy the Russian authorities with impunity. Their personal habits are too disgusting for description; their national customs are revolting in their cruelty; their religion seems to be a form of devil-worship presided over by Shamans, or medicine-men. Their lives are a prolonged struggle against the adverse forces of nature, and Mr. de Windt justly considers them as an example of "the survival of the fittest."

We must add that the book is well illustrated and equipped with an excellent map.

Egypt in 1898. By G. W. STEEVENS. Edinburgh and London: William Blackwood and Sons, 1898. Pp. 283. *Price* 6*s.*

One of the liveliest books on contemporary Egypt, this volume also contains much that is worth the attention of the politician and the tourist. Mr. Steevens is evidently a keen observer of most things, and took much pains to master the com-

plications of modern Egypt. Among his studies, that of the Egyptian schoolboy is one of the most novel and entertaining. He says that whilst poor Egyptian boys prefer learning English, as being now the more useful language, the sons of Pashas continue to learn French. He found a leading school, which he calls "the Egyptian Eton," divided into an English and a French side. "The best-bred boys, the sons of Pashas, are on the French side. If you go into the dining-room—or rather the dining-rooms, for the two sides eat apart—you will find that on the French side they understand the use of knives and forks and spoons, and do not throw their bones under the table. On the English side it requires a perpetual struggle to prevent young Egypt from committing such atrocities. But it is only natural that the Pasha, who was brought up to consider French the official language of civilisation, who has himself talked French all his life, should send his son to the French side. But the poorer man, whose son must make his own career, sends him to the English side. . . . We do not enforce our own language, but let them find out the utility of it for themselves. We are in no hurry; we are not going away; and time is on our side."

The author's chapter on "Lord Cromer and his work" is an admirable epitome of the political situation. "France has sulked, and because she has sulked her policy in Egypt has been a string of blunders. She locks up Egypt's money in the Caisse de la Dette: well, then, it will only take us the longer to put the country in order. She refuses funds for the reconquest of the Sudan: well, then, Britain advances it, and is it likely Britain will let go of territories conquered with her own money? She refuses funds for the Nile Reservoir: well, we are certainly not going to leave Egypt without it. She refuses to modify the Capitulations, or even to give up her separate Post-office: well, is a country that is unfit to manage its own Post by itself fit to manage anything?"

With regard to the author's statement that France refused funds for the proposed Nile Reservoirs at Assuan and Assiut, Lord Cromer has shown in his masterly *Report*, published in May 1898, how the Egyptian Government is going to pay for them itself "by semestrial payments of £78,613 over a period of thirty years, beginning from the 1st July 1903," the total probable cost (including the Ibrahimieh Canal) amounting to £2,000,000. Lord Cromer is also more hopeful than the author regarding the result of the recent remarkable "réveil intellectuel" in Egypt.

Mr. Steevens concludes with rather a vulgarised version of Egyptology after the manner of the *Innocents Abroad*, and records his conviction that Rameses the Great "must have been a chubby little fellow, and looks rather like a good-tempered baby in a false beard." For one professing to have visited Abú Simbel, this is a singularly irreverent and incorrect statement.

The Flora of Perthshire. By Francis Buchanan W. White. Edited by James W. H. Trail, Professor of Botany, Aberdeen University. Edinburgh: Printed for the Perthshire Society of Natural Science by William Blackwood and Sons, 1898. Pp. lix + 407. *Price 7s. 6d. net.*

This is a good book of a good kind. It deals with the flowering plants, ferns and allies, and algæ of Perthshire, and is illustrated by a portrait of the author and a specially prepared map. The introduction, life of the author, and other additional matter, are from the hand of Professor Trail, who has further made additions to the body of the work, where it was left incomplete by Dr. White at his death, and has brought it into final shape for the press. Dr. White, one of the founders and the first president of the Perthshire Society of Natural Science—for

which this volume has been printed—was an excellent example of that valuable type of modern working naturalist who, instead of taking all knowledge for his province, limits himself to a province, within which he seeks to attain all knowledge. His province was his native county, and this book—unhappily posthumous—embodies his chief direct contribution to natural science; he did much good work indirectly too, in the way of inspiring and encouraging, assisting and directing, other observers. The book itself contains a great body of botanical information, conveyed in a highly condensed form by help of the map and of ingenious forms and symbols employed in the text. Professor Trail's contributions are of great interest, and his work in putting Dr. White's text into final shape has been done with scrupulous care. A small flaw falls to be noted; the symbol (!), recurring repeatedly in the text, seems to be explained only on p. 193, and there only in so far as it refers to the single genus *Hieracium*.

Autour de la Méditerranée. Les Côtes Latines. L'Italie (de Vintimille à Venise). Par MARIUS BERNARD. Paris: Henri Laurens, 1897. Pp. 400. *Price* 10 *francs*.

Italy forms a portion of the second series of this great illustrated work, the other two series being *Les Côtes Barbaresques* and *Les Côtes Orientales*. The present volume contains a sketch-map of Italy, and also 120 illustrations by H. Avelot, the printing of which does not always do justice to their artistic quality. The Italian Riviera, Tuscany, Etruria, Ancient and Modern Rome, Naples, Sardinia, Mount Vesuvius and Pompeii, Sicily and Mount Etna, Calabria and Apulia, the Marches of Ancona, and Venice are all described with picturesque vigour. Malta and Gozo are, with considerable latitude, included in the chapter on Calabria and Apulia; and to Malta, we are informed, "England has felt it to be her duty to transport her stiffness, cant, and spleen." The author also expresses the novel opinion that, if it had not been for Bonaparte, "the Britannic octopus would never have grasped Malta with its tentacles," the truth being that, on account of ill-treatment, the Maltese rose against the French and expelled them with British aid. M. Bernard's geology seems as dubious as his history, for he states that Malta is "d'origine volcanique," whereas, as shown by Dr. John Murray (*Scot. Geog. Mag.* vol. vi. 479), the tertiary rocks of which Malta is composed are of marine origin, and indicate by fossils their deposition along a continental coast-line.

With Peary near the Pole. By EIVIND ASTRUP. Translated from the Norwegian by H. J. BULL. London: C. Arthur Pearson, Ltd., 1898. Pp. 362. *Price* 10*s*. 6*d*.

Herr Astrup was one of the energetic band of explorers who accompanied Peary in his expeditions to Greenland in 1891-92 and 1893-94. In this volume he gives us a pleasantly written sketch of the routes taken and of the places reached, but wisely avoiding ground so admirably covered by Peary, he mainly confines himself to descriptions of the Eskimo whom he met, and of whom he shows himself a close observer. He dwells upon their good temper, hospitality, gentleness, kindness, morality, and other amiable qualities, while he does not conceal their deficiencies of cleanliness, etc., which make a sojourn among them so trying to any one but a seasoned Arctic traveller. He has much information to give us regarding their domestic manners and customs, and their religion. Notwithstanding the plethora of recent publications regarding the Arctic regions, this volume is well worthy of perusal.

The translator, H. J. Bull, of Antarctic fame, has given a very free rendering of the original, omitting or condensing to a considerable extent in some of the chapters. In most cases the pruning has been done judiciously. It is not easy to see, however, why a passage on the stature of the Eskimo, on p. 67 of *Blandt Nordpolens Naboer*, has been passed over. Again, on p. 80 of the translation "the common or small auks" should be "the Little Auk, or the common auk" (Razorbill). It is the skin of the former that Astrup speaks of as very small. There are also several verbal mistakes, such as "cheeks" for "jaws" (p. 75); "twenty miles" for "twenty kilometres" (p. 174); "native" for "Canadian" snowshoes (p. 179); "cape" for "cap," or rather "hood" (p. 181); "farther off" for "farther north" (p. 351), etc. Few of these are of real importance; on the whole, Mr. Bull has performed his task better than many who translate books into their native language.

Les Lacs Français. Par André Delebecque, Ingénieur des Ponts et Chaussées. Paris: Typographie Chamerot et Renouard, 1898. Pp. 436.

It is some years since M. Delebecque began the examination of the lakes of France, and combined the results of his soundings in an atlas of thirty-two lakes. In this volume he describes his instruments and methods, and sketches the principal characteristics of the lakes, dividing them into eight groups—the lakes of the Alps, the Jura, the Vosges, the central plateau, the Pyrenees, the Atlantic littoral, the Mediterranean littoral, and various small lakes scattered over the Landes, Provence, Normandy, etc. He also treats of the feeding and drainage, nature of the bottom, temperature, and other questions. The greater number of these lakes have never been scientifically examined, and in the case of the Lake of Geneva, which has attracted more attention than any other, and of Gérardmer, Longemer, and Retournemer in the Vosges, investigated by M. Thoulet (*see* vol. xi. p. 417), he has additional observations to record, or new suggestions to make on their configuration and formation. M. Delebecque's labours were not confined to the thirty-two lakes mentioned above; he has also ascertained the maximum depths of many other less important or less easily accessible sheets of water. And, further, he seeks to show how the basins of lakes in general are formed, their drainage affected, and their temperature regulated, using his observations as illustrations.

It is to be regretted that his charts have no land contours, but their absence, we learn, is not due to the author's neglect; the maps of the General Staff are not sufficiently exact to furnish material for the delineation of contours on a large scale. We should like to see the contours of all lake charts referred to sea-level.

The volume is well got up and illustrated with a number of views, which are not only attractive to the eye, but in many cases show the character of the lake basins.

From Ocean to Ocean. Across a Continent on a Bicycle. By Jerome J. Murif. Melbourne, London, etc.: Geo. Robertson and Co., 1897. Pp. 192.

To cross the continent of Australia from Adelaide to Palmerston on a bicycle is a formidable enterprise, for the route is often rough, and wells few and far between. Perhaps many cyclists may follow in Mr. Murif's footsteps, with the help of his experience, and as settlement extends further from both north and south: but the pioneer had many difficulties to contend with. The book is written in rather a rough-and-ready style and with a good deal of Australian slang, and trimming would here and there improve it. There are, however, some

interesting notes on the country, natives, trees, ants, etc. On pp. 124 and 125 M'Donnell range is printed instead of M'Douall, an error that may lead to some confusion.

Earthquakes and other Earth Movements. By JOHN MILNE, F.R.S., F.G.S. ("International Scientific Series.") London: Kegan Paul, Trench, Trübner and Co., 1898. Pp. 376. *Price* 5*s.*

The first edition of this work appeared as long ago as 1883, and no radical change has been introduced. A few references to recent investigations and a few more illustrations have been added. The name of the author is a guarantee of reliability of the book as a concise account of the phenomena it deals with.

The Voyages of the Cabots: Latest Phases of the Controversy. By S. E. DAWSON, Lit.D. London: B. Quaritch, 1897. Pp. 129. *Price* 5*s.* (From the *Transactions of the Royal Society of Canada for* 1897.)

In this interesting and valuable paper Dr. Dawson leads an elaborate argument to prove the correctness of his contention that in 1497 John Cabot planted the English flag on the east coast of Cape Breton. Other authorities, such as Mr. G. E. Weare (*rec.* vol. xiii. 503) and Mr. Henry Harrisse (*rec.* vol. xiii. 614), considered that the evidence is not sufficiently reliable to enable us to locate the landfall with any degree of certainty. Dr. Dawson's paper is copiously illustrated, and contains excellent large facsimiles of the World Map of Juan de la Cosa, A.D. 1500, and the Sebastian Cabot World Map of A.D. 1544.

Dizionario Geografico Universale. Del Prof. G. GAROLLO. Quarta Edizione. Milano: Ulrico Hoepli, 1898. Pp. 1451. *Price L.* 10.

The present edition may almost be considered a new work, for it contains fully 114,000 entries, while the earlier issues contained only about 25,000. It forms a small, though thick, volume, and gives some few data about the smallest places, such as population, situation, etc. These, as far as we have tested them, are in general correct. In one or two cases the population is not quite exact, a pardonable error in such a vast accumulation of information. As a hand gazetteer this work is worthy of high commendation.

The Royal Dee: a Description of the River from the Wells to the Sea. By ALEX. INKSON M'CONNOCHIE. Illustrated by I. E. MURRAY. 4to. Aberdeen: Jolly and Sons, 1898.

Mr. M'Connochie's merits as a writer on the Queen's country have already been recorded in this *Magazine* in a review of his excellent guide-book to Deeside. Though entirely rewritten, and with new illustrations, the *Royal Dee* may be almost considered as an enlarged and glorified edition of the smaller work. The new volume is well got up, and contains upwards of ninety dainty illustrations of scenery by Mr. I. E. Murray, clearly printed. The visitor to this part of Aberdeenshire could have no better souvenir of the district than this elegant quarto.

The Queen's Empire. A Pictorial and Descriptive Record. Illustrated from Photographs. London, etc.: Cassell and Co., 1897. *Price* 9*s.*

This collection of photographs is not only superior in artistic quality to many that have been previously published, but it has also the advantage of a systematic

arrangement. It is divided into twelve sections illustrating so many phases of human life, such as sports, religions, dwellings, modes of conveyance, etc. It may be questioned whether an arrangement under the headings of the various countries that compose the Empire would not have been more useful and convenient, so that various occupations in the same country might have been represented in consecutive views. To some extent this is provided for in the index, where the views are thus grouped together.

Mr. Arnold Foster, M.P., contributes an explanatory introduction.

Copenhagen and its Environs. Handbook for travellers, published by the Danish Tourist Society. Pp. 63. *Copenhagen, the capital of Denmark.* Pp. 112. London: Simpkin, Marshall, Hamilton, Kent and Co., 1898.

The former of these books is a guide of the usual kind, containing information respecting hotels, means of conveyance, and the buildings, etc., most deserving the attention of tourists, and is accompanied by a clear plan of the city. The other, a well-illustrated description of Copenhagen, treats of subjects of more general interest, such as history, climate, and institutions, as well as of the sights of Copenhagen. Both will be of service to the visitor of this interesting northern capital.

Brighton and its Environs. Buxton and the Peak Country. Matlock, Dovedale, and Central Derbyshire. Edited by A. R. Hope Moncrieff. London: A. and C. Black, 1898. *Price* 1*s. each.*

These three small volumes are exceedingly handy guides, containing sufficient information to direct the visitor, and not too much. Two of them have already run through several editions, while the *Guide to Matlock* is new. They are well furnished with good maps. The advertisements occupy a considerable space, as is often the case in guide-books.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. London: Charles Griffin and Co., 1898. Pp. 281. *Price* 7*s.* 6*d.*

We have noticed this work each year, and as the present issue contains no new feature, we need only make known its publication. As usual, it gives not only a list of the societies, but also a record of the work done by them during 1897. Its utility is therefore self-evident.

Voyage au Pays des Fjords. Par Antoine Sallès. Paris: Plon, Nourrit and Cie., 1898. Pp. 304. *Price Frs.* 4.

After attending a Congress of the Press at Stockholm, Mr. Sallès made a tour in Norway, travelling by rail to Trondhjem, and thence proceeding to the North Cape. Returning south to Christiania, he passed through Telemarken to Bergen and the Sognefiord. He has much to say on the personal incidents of his journey, but his descriptions of the country are too general and defective. Thus of the route from the Nordsjö to Dalen we have little more than an enumeration of the lakes passed through, with a bare allusion to the canal works, though they are no despicable achievements of engineering skill. Again, the beautiful Röldalsvand is not even mentioned, though the author passed a night on its banks. Readers who are fond of a light, chatty book will find this one to their taste, but they will not gain from it a very distinct idea of the country. M. Sallès seems to have travelled too rapidly, and was further handicapped by ignorance of both Norwegian and English. The illustrations are good.

NEW MAPS.

EUROPE.

FORMA URBIS ROMÆ. Formam dimensus est et ad modulum 1 : 1000 delineavit Rodolphus Lanciani, Romanus. Fasciculus Quintus.

Presented by Mrs. Hugh Rose.

AFRICA.

NIGER AND UPPER NILE QUESTIONS, Maps to illustrate the ——. *Price* 2*s.*

W. and A. K. Johnston, Edinburgh.

AFRIQUE (Centrale et Australe). Pars le Colonel Noix. Scale 1 : 8,000,000.

Ch. Delagrave, Paris.

This is a new edition of the map noticed in vol. xi. p. 439. It may be remembered that its chief recommendation is that the dates of the treaties affecting boundaries are printed on it. The present issue is apparently simply the old sheet with corrections. The new boundaries of Togoland and Sierra Leone are roughly indicated, but not that of British Somaliland, which probably was not known in time for insertion. There are also one or two other changes.

Though on the whole a useful map, it contains one or two very antiquated errors. Mfumbiro figures in British territory, and Swaziland has a colouring of its own.

AFRICA ORIENTAL PORTUGUEZA. Escala 1 : 1,000,000. Folha 4. Zumbo-Tete. Folha 8. Quelimane-Sofala. *Commissão de Cartographia, Lisbon.*

AUSTRALASIA.

TASMANIA, Map of ——. Scale eight miles to one inch.

Lands and Survey Office, Hobart, E. A. Counsel, Surveyor-General.

We are glad to receive this map, which will, no doubt, prove very useful. The execution might be improved and the features rendered more distinct; the railways, in particular, should stand out more prominently. The map contains, however, much information not to be found elsewhere.

CHARTS.

APPROACHES TO KIRKWALL. Scotland, No. 2584. Surveyed by Captain W. Usborne Moore, 1895-96. *Presented by the Hydrographer.*

AFRICA, COSTA ORIENTAL. O Rio Limpopo desde a sua Foz até a Confluencia do Chengane. 1897.

—— Barra e Porto de Angoche. Escala 1 : 40,000. 1897.

AFRICA, COSTA OCCIDENTAL. O Rio Geba desde a Foz do Corubal até Gebe, 1897.

Rio Corubal entre o Rio Geba e Porte Ugui. Escala approx. 1 : 72,000. O Rio Peter. Escala approx. 1 : 25,000. 1897.

O Canal de Impernal e Rio Mansôa desde a Foz do Impernal até Porto Mansôa. 1897.

O Rio Mansôa desde a sua Foz ao Impernal. 1897.

Esboço da Communicação entre o Rio Tombali e o Cacine. 1897.

O Rio Cacheu. 1897. *Commissão de Cartographia, Lisbon.*

POSITION OF ROCKALL BANK

10
8
6
4
Faroe-Shetland depression
Orkney Is
Dunnet Hd
Cape Wrath
Butt of Lewis
Outer Hebrides
Lewis
The Minch
Harris
St Kilda
North Uist
Benbecula
South Uist
Barra
Rum
Coll
Tyree
Colonsay
Islay
Tidal Bank
Moray Firth
Ben Nevis
Mull
Firth of Lorne
Firth of Clyde
Kintyre
Mull of Kintyre
Malin Head
Lough Swilly
Tory I
Bloody Foreland
Aran I
Inishmore
Malinmore Head
Blue Stack
St Gallion
Donegal Bay
Benwee Head
Erris Bay
Achill I
Clare I
Inishbofin
Slyne Head
L Mask
L Corrib
Galway Bay
Aran Is
St Brigid's
Mal Bay
Slyne Head
Lough Derg
Shannon
Erne
L Erne
L Allen
Blacksod Bay
Donegal Bay
Sligo Bay
Tralee Bay
Dingle Bay
Dublin Bay
Lambay I
Howth Hd
Ireland's Eye
Lambay I
Wicklow Hd
Braich y Pwll
Calf of Man
Mull of Galloway
Strangford Lough
Dundalk Bay
Carlingford Lough
Dundrum B
Lough Neagh
Belfast Lough
Larne
Barra Head
Hebrides
Lewis
Harris
Rhu Stoer
Rhu Reed
Rhu Arnol Pt
Rhu Dewick
Rhu Shian
B More
B Dearg
E Wervis
Beauly
Findhorn
Nairn
Spey
B Muchalls
B Lowers
B More
B Vourich
L Lomond
Crinan Canal
Loch Fyne
Loch Etive
Loch Linnhe
Corryvreckan
Jura
Islay
Oban
Arran
Ayr
Doon
Merrick
Dee
Solway Firth
Isle of Man
Douglas
Peel
Ramsey
Laxey
Point of Ayre
Calf of Man
Howth
Dublin
Wicklow
Arklow
Rosslare
Tuskar Rock
Carnsore Pt
Waterford
Cork
Kinsale
Old Head of Kinsale
Fastnet Rock
Skellig Rock
Valentia I
Dingle Bay
Tralee Bay
Blacksod Bay
Clew Bay
Achill I
Clare I
Inishbofin
Slyne Head
Galway Bay
Aran Is
Lough Derg
Shannon
Erne
L Erne
L Allen
Donegal Bay
Sligo Bay
Benwee Head
Erris Bay
Malinmore Head
Inishmore
Tory I
Lough Swilly
Malin Head
Bloody Foreland
Aran I
Blue Stack
St Gallion
Lough Neagh
Belfast Lough
Strangford Lough
Dundrum B
Dundalk Bay
Carlingford Lough
Lambay I
Howth Hd
Dublin Bay
Wicklow Hd
Braich y Pwll
Calf of Man
Mull of Galloway

CHART OF ROCKALL BANK

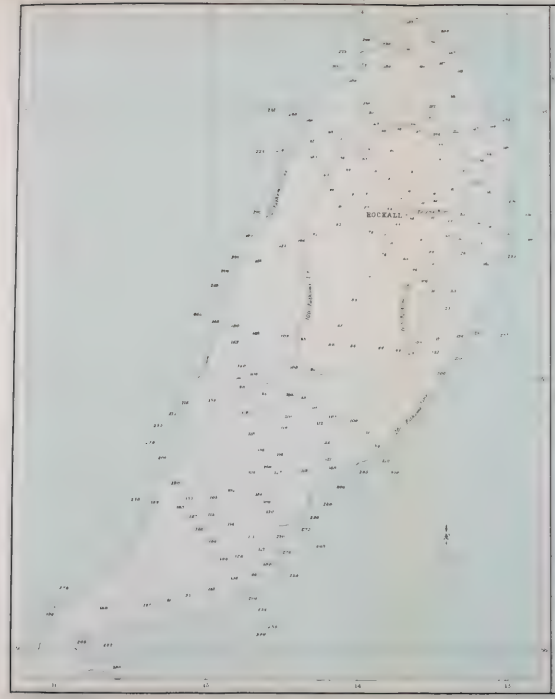

CHART SHOWING POSITION OF ROCKALL BANK

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

SOUTH TENASSERIM AND THE MERGUI ARCHIPELAGO.

By Wm. Sutherland,

Assistant Superintendent of Telegraphs, Lower Burma.

Having had occasion to be in the Mergui district on duty during the latter part of 1897 and the beginning of '98, I accomplished a march on foot from Mergui to Victoria point, which had not been previously done by a European, and the following description of the journey and incidents in it may perhaps be of interest.

The object of the journey was to inquire into the practicability of erecting a telegraph line between these two points, and, should the country be favourable, to select a route. The march was done on foot, owing to the impossibility of any other means of locomotion by land.

Mergui, the headquarters of a district of the same name in South Tenasserim, is situated on the west or ocean side of Mergui island, its anchorage being protected from the full force of the SW. monsoon by several smaller islands of the archipelago. Mergui island, one of the two hundred islands which make up this archipelago, lies between two of the several mouths of the Tenasserim river, the Kyauk Pea river on the north and the Main Mouth on the south. The river has altogether six more mouths at distances of 8, 15, 25, 28, 35, and 38 miles in a direct line south of Mergui island.

A weekly steamer carries the mails between Rangoon and Mergui, and this is the farthest southern point in Burma at which a regular line of steamers calls.

Leaving Rangoon by this steamer, and dropping down the Rangoon river to Elephant point, we crossed the Gulf of Martaban, dirty in colour at all times, and dirtier still in weather at certain seasons, south-east by south towards the three groups of islands known as the Northern,

Middle, and Southern Moscos. These islands extend in a chain parallel to the coast, and at a distance varying from nine to thirteen miles from it. On the usual course the steamer keeps outside the Northern islands, and passes between them and the Middle islands, leaving the Cradles on the land side. The Cradles are a group of four rocks between the Middle Moscos and the mainland. These rocks are mere shells, hollow inside, with several cave-like entrances, and are one of the three breeding-places in the Mergui district of the swallow the edible nests of which are so much prized as a delicacy by Chinamen. Another of these nesting-places is in a group of rocks off the east coast of Tavoy island, and several caves in the hills on the island itself. The third is at the Marble rocks or Elephant islands, which are east of Domel and west of Kisseraing island, farther south in the archipelago. The right to collect and sell the nests is sometimes let by public auction, and sometimes retained by Government. One of the conditions of a lease is that a certain percentage of the nests shall be left undisturbed. They are of two qualities, one light in colour and the other dark, the former being inferior. "The nests are gathered by means of a long bamboo pole with an iron fork at one extremity and a lighted torch at both, the one to show the nest and the other to show the barefooted collector where he may securely tread." They fetch, in the Straits, £7 per lb. weight, and each nest weighs between a half and one ounce.

On leaving the Cradles, a straight line is made past the Southern Moscos for Cap island, off Tavoy point; the point is turned, Crab island passed, and the anchor dropped in Tavoy river at the village of Sinbyubin, off the tail of Long island. A small vessel takes the mails down from Tavoy to this point, a distance by river of twenty-six miles, puts them on board, and then the ship proceeds down the coast past Tavoy island to Mergui. Tavoy island is about eighteen miles long by two broad, and has a bay called Port Arthur on its east coast, a good refuge from monsoon weather for vessels in distress. The state of the tide on arrival at Mergui influences one's first impressions to a great extent. With a low tide a large expanse of muddy foreshore is exposed, and a considerable quantity of unhealthy and unpleasant gases let loose; but at high tide the water is several feet deep under the floors of the houses in the town, which are built on piles, the mud-banks are covered up and, besides the town, there is nothing but water, sky, and vegetation visible. A short distance back from the water's edge the ground rises abruptly, and there is a small hill on which several pagodas, the Government offices, and the officials' houses are built. From this hill the view is pretty and extensive, and a lovely breeze blows off either the sea or the shore almost unceasingly.

Mergui is the permanent headquarters of the European pearlers of this archipelago. The native town population consists of Burmans, Karens, natives of India, Chinamen, Siamese, Malays, and Japanese. The pearlers have their houses here, but the present scene of operations is Penguin bay, a small bay on the north-west of Malcolm island. They anchor their schooners in this bay, about 200 yards off a sandy beach, in ten fathoms of water. Each pearler, or firm of pearlers, has his

schooner and native boat or boats, the former to live in, and the latter containing the pumps and diving apparatus, to dive from. Up till now, most of the pearling by Europeans has been done round Malcolm and Page islands, but Chinese pearlers fish farther north, with Ross island as headquarters, and the neighbourhood of Ross, Elphinstone, and Grant islands as their fishing-grounds. The right to fish on these grounds is, like the right to take nests in other places, sold by public auction in the court of the Deputy Commissioner at Mergui, and the licence includes *bêche de mer* and green snails.

The gross value of the pearls found annually is more or less a matter for speculation. There are many reasons why the catch cannot be accurately valued. The fact that income-tax has to be paid on the value of all declared findings doubtless keeps many fine pearls out of sight, and if a man has a particularly good haul, he does not send the town crier round to say so. Again, many pearls found never even reach the pockets of the employers of the divers, but are spirited away by the latter and sold on the quiet. There are no European divers: they are all Burmans, Japanese, and Manillas. Considerable jealousy exists among these men, and many tricks are resorted to to outwit each other, and, by gaining the reputation of a very successful diver, to be able to demand enhanced wages. It is common for one diver, if he sees that another has lighted on a good bed of shell, to go up behind him and pull his communication cord, and have him hauled up to the surface. When the man reaches the top, gets his headpiece screwed off, and recovers sufficiently to be able to talk, he explains that he did not pull the cord himself. It is too late then, however, as the first man has already got the shell. The shells are packed and exported, and a fairly uniform rate of £130 per ton in the rough is obtained for them in England. The fishing season lasts only from November to April, and diving operations have to be suspended during spring tides.

The pearl oyster is found on mud, sand, and rock bottom, but to a much less extent on rock. This may be due to a preference for mud or sand on the part of the oyster, or to the fact that there is much more mud and sand than rock. Those found on a rocky bottom give a greater weight of pearls per number of shells than those found on sand, and similarly those on sand give better results than those on mud. The method of separating the pearl from the flesh is, quoting Captain F. D. Maxwell, as follows:—"The oysters having been collected, are put into a large caldron of hot water till they open. The flesh is then scraped off the shell with a knife, and thrown into a basin. When the basin is half full it is put into the sun, and the flesh allowed to decompose. After three or four days, when the flesh has more or less thoroughly decomposed, water is added, and the whole mass stirred. The pearls, being heavier than the decomposed and decomposing oysters, fall to the bottom, and are easily got out of the basin. The rest is then passed through a fine sieve, so that no pearl of even the smallest description shall escape. The only things that appear to receive no consideration in the matter are the oysters. Some Burmans are of opinion that the fish survive their immersion in the hot water for several hours."

However, to return to Mergui, which was the starting-point of the journey: I halted there for a few days to make arrangements for transport, find out what was known about the country I was to go through, and obtain a military police guard from the Karen battalion, a detachment of which is stationed at Mergui. The mainland south of Mergui is practically unknown; there are no roads, or, to be accurate, I travelled over nine miles of road in a 326-mile march. There are no towns south of Mergui, and what villages there are are on the rivers and creeks. There are no villages off the waterways, and consequently no inland roads. Neither are there roads along the rivers, creeks, or coast between the villages, boats being the only means of locomotion and communication made use of. Again, nearly all the villages are on tidal creeks and the tidal portions of rivers, so that, by suiting their movements to the tides, the natives can boat from one place to another without using an oar and without any exertion whatever. This being so, and Burmans and Siamese being, as they are, pre-eminently lazy, it is doubtful whether roads, if constructed, would be used by them. The fact that the country along the waterways is mainly mangrove swamp practically renders the making and maintaining of roads impossible. Consequently, the only transport I could obtain was coolies, and the amount of kit had to be reduced to a minimum. The usual tent, table, chair and bed had to be left behind, and nothing but a few blankets, some medicines, cooking pots, and changes of clothes taken. The direct distance between Mergui and Victoria point is 180 miles, but, what with mangrove swamps and other impassable pieces of ground, the route I followed, and which I believe to be the shortest possible land route, was 326 miles. The coast cannot be followed on account of the vast expanse of littoral forest that extends along it, and on account of the numerous and wide indentations and river estuaries. To get south, one has first to reach Tenasserim, about forty-two miles inland from Mergui. To reach Tenasserim, one has to go northwards along a cart road to the village of Sandawut, about seven miles from Mergui, and about two-thirds of the way across Mergui island in a north-easterly direction from the town. From there I struck back into the jungle in a south-east direction till I reached the Mahat creek, crossed it at the village of Paneydaung and the Kyauk Pea mouth of the Tenasserim river on to the mainland at Binlaing, halting for one night at each of these places. The detour from the Main Mouth north-eastwards to Sandawut and back to the Mahat creek is necessitated by the prevalence of mangrove forest along the shore at Mergui. The road from Mergui to Sandawut is very rough and badly bridged, but, being a road, is a thing to be thankful for and not to be complained of. Having arrived at Sandawut, I had two more miles of road to look forward to in the remaining 319 miles. From that village to the Mahat creek there is a sort of path running through thick jungle, submerged in many places, overgrown in others, and, except perhaps when the sun is at his highest, never exposed to light or heat. The bed of the Mahat creek, which is a tidal one, is about 120 yards broad, but there are other 120 yards of mud on the left bank, which is submerged at high tide and on which *Dhunny* palm is cultivated. The leaf of this palm is

MERGUI.

KAREN VILLAGERS.

A FISHING VILLAGE.

the thatch used by the villagers for their houses, liquor is extracted from the palm itself, and sugar is manufactured from the juices. It grows wild in places, but is cultivated in many more—in fact, wherever there is a hut there is mud, and wherever there is mud there is Dhunny.

The Kyauk Pea river at Binlaing is about the same size as the Mahat creek, and similarly lined on both banks with this palm. From Binlaing to Tenasserim the direction is east and slightly south, along the Sabubla creek and the right bank of the Tenasserim river. The Sabubla is a branch, or rather loop creek, breaking off from the river at the village of Mahtôn and returning to it near Sindin. There is a fresh-water stream of the same name flowing into the creek at the Sindin end. In going up the right bank of the Tenasserim from Mahtôn, the river has to be crossed to Tenasserim town, which is on the left bank. The town is, roughly speaking, in the elbow of the Tenasserim and the Little Tenasserim rivers. The Great Tenasserim river from the north, and the Little Tenasserim river from the south, run into each other at Tenasserim town, and together flow westwards to the sea as the Tenasserim river. The Little Tenasserim river is formed by the junction of the Thinkôn and Ngawôn rivers, thirty-two miles up from Tenasserim. The Thinkôn river, running WNW. with a big south-westerly bend near its centre, has its source in a range of hills forming part of the natural boundary between Burma and Siam. The Ngawôn river,[1] which runs almost S. to N., has its source on the eastern slopes of a range which, running from NE. to SW., forms the watershed of the Legnya and Ngawôn basins, and which, at its SW. extremity, runs into the Siamese boundary range. This latter range is better known in Burmese as the Maw-daung range or Tired Hill, and in Siamese as the Khow-maun or Pillow range. The Great Tenasserim river is formed by the junction of two streams at the village of Myitta, in the Tavoy district.

In the elbow formed by the junction of the Great and the Little Tenasserim rivers are two small hills of about 150 feet in height, running right down into the water, and Tenasserim is built round the lower contours of these hills. It is called a town more on account of old associations than its present importance. As a Siamese town it was of a certain importance, but after its capture by the Burmans, and during the frequent raids to which it was subsequently subjected by the Siamese, it dwindled away, till now there are only a few houses remaining. About a quarter of a mile behind the present village there is a massive stone pillar, several tons in weight, roughly cut and covered over with a thatch roof, which is said to have once been the centre of Tenasserim city, and was planted at the founding of it by the Siamese in 1373 A.D. The story is told by the natives that, when the pit was dug to plant this stone in, a live woman was first thrown in and the pillar planted on the top of her. This woman is now the guardian angel of the city. In its prosperous days it was surrounded by a brick and mud wall, enclosing about four square miles of land. The foundations are still traceable in

[1] Not to be confounded with the Bassein or Ngawôn river, which is one of the mouths of the Irrawaddy river.

places, but the wall itself has been dismantled, and the serviceable bricks used elsewhere for building purposes, principally in jails for local culprits.

From Tenasserim I struck up the Little Tenasserim river and the Ngawôn river, keeping partly to the right and partly to the left bank, until I reached the village of Klaung-Yein-Kwam, about thirty-seven miles up-stream from Tenasserim by land, halting for a night at Indaw and Ngawôn, crossing the Little Tenasserim river at Lepanthoung, the Thinkôn river about one mile above its junction with the Ngawôn river, and the Ngawôn river at some huts which form part of the scattered village of Ngawôn. Up to Tenasserim, Burmans and Karens predominate, but Le Taungya, the first village up the Little Tenasserim river, is purely Siamese. From Tenasserim southwards the people, their dress, style of houses, and language are different, and, indeed, one seems to have left Burma behind. This is really the case, as southwards of Tenasserim one rarely sees any people but Siamese until the extreme south of Burma is reached, where Malays predominate, and the Malay tongue is the most generally spoken and understood. Between Mergui and Klaung-Yein-Kwam I made eight marches, the distance being 106 miles. This does not give many miles per day's march, but the difficulties of the ground have to be taken into consideration. Many creeks, tidal and otherwise, had to be crossed daily. A tree, conveniently fallen across and bridging a creek, was sometimes found and promptly made use of, to save, not the wetting, but the mudding. These occasions were unfortunately conspicuous by their rarity, and in most cases we were compelled to swim if the tide was up, or wade up to the waist, if it was out, in greasy mud, which penetrates through every eyelet-hole in one's boots. Perhaps within the next mile a running stream has to be waded, where the water washes the mud out again but leaves sand and grit behind, so that one's heels are apt to get badly chafed.

Up to Klaung-Yein-Kwam I always managed to halt at a village of some description, and get a shake-down on the bamboo floor of the *Thugee's* (head-man's) house. As long as the villages were Burman a fairly clean house was generally obtainable, but my experience of Siamese houses was anything but pleasant. The huts are dilapidated and dirty, built of bamboo on wooden piles, and thatched with Dhunny palm. They appear to be never cleaned out, and are inhabited till they fall to pieces, or till a merciful Providence sends a storm which ruins them and compels the inhabitants to rebuild.

The prevalence of white leprosy and several loathsome skin diseases was very noticeable in the villages of the Little Tenasserim valley. In some the inmates of every house appeared to be suffering from disease. At Indaw village every one in the house in which I slept was diseased. At this particular place the water was probably mainly responsible, being quite the worst I have ever seen used for culinary purposes. It was taken from a buffalo wallow, which was also frequented by ducks and pigs, wild and domestic. It was dark brownish-black in colour and slimy to the touch; my Pasteur filter was put to the severest test it has ever undergone, and I had to wash the three filtering candles each three

times before I got a quart of water through them. At Klaung-Yein-Kwam the whole village was so uninviting that I slept in the open, under a mosquito net, to keep off the fog as much as possible. River fogs are prevalent all over the district during the cool season, and in many places the sun does not penetrate them till midday.

From Mergui to Tenasserim the country varies very much. In some places it is flat, swampy, intersected and cut up by tidal creeks, and very unhealthy. Wherever there is a village there is a patch of *paddy* (rice) cultivation—not extensive, but sufficient to supply the village with rice and leave a small margin for sale, the proceeds of which go to buy a few luxuries. In other places, especially between the Sabubla creek and Tenasserim, the country is mountainous, and the hills are covered with forest and a dense undergrowth. Along the Tenasserim river the hills run sheer down into the water, marks of landslips are frequent, and the scenery as seen from a canoe is very pretty. Going by land, as I did this time, I could obtain no view anywhere, everything beyond a few yards being shut out by jungle and undergrowth. At a later date, however, I went up the river in a canoe, and appreciated the trip a good deal more than if I had never gone by land.

From Tenasserim to Klaung-Yein-Kwam I kept as close to the Little Tenasserim and Ngawôn rivers as was practicable. Their immediate vicinity is low-lying and swampy, there are many tidal tributaries and fresh-water streams, the jungle is dense and matted together with creepers, but neither high nor heavy, and the soil is inundated for many months every year. The Little Tenasserim river is navigable by medium-sized native boats up to the junction of the Ngawôn and Thinkôn rivers. The boats used are peculiar to this part of Burma, are of very shallow draft, have a large sail area, and are well adapted to sailing in the light winds which prevail during the greater part of the year. During the monsoon they have to lie up. I had one of these boats with me, which I sent from point to point on the river and coast, while I marched overland to see how far the various rivers and creeks were navigable. The boat, in Burmese parlance, drew two hands of water empty, four hands fully loaded, and carried 126 baskets of rice. A basket of rice weighs about 56 lbs., so that it could carry 7000 lbs. in 16 inches of water. Above the junction of the two streams only canoes can get up, and even with them frequent stoppages have to be made to clear away snags.

From Klaung-Yein-Kwam I struck SE. for the Mônôrôn river, a tributary of the Legnya river. The Mônôrôn range, forming the watershed between these two rivers, is more densely wooded than any piece of country I had seen up to that time. The timber is taller and straighter, the bamboo clumps of greater diameter, and the single bamboos of heavier growth than elsewhere. The easiest mode of progression, when practicable, was to wade along the bed of the Klaung Sâk, a small tributary of the Ngawôn river rising in the Mônôrôn range. At times, however, its bed had to be left, and a way cut through the jungle. Formerly, about once a year, the Karens who live on the banks of the Mônôrôn river used to drive buffaloes from the Mônôrôn valley across this range to the Ngawôn valley, and the tracks of these animals served as a guide. For the two

years previous to my going across, none had been taken over, and every trace of former herds had been obliterated. It rained very hard all through the first day on these hills, and the leeches, which the rain brought out, were quite unbearable. They penetrated through the eyelet-holes of one's boots, and a halt had to be called every mile or so to partially undress and pull off the most aggressive. A halt for the night was made at the source of the Klaung Sâk, and a bamboo and palm-leaf hut was built. The extra time and trouble spent in thatching the hut was wasted, because, when the coolies arrived, all my blankets and clothes were already wet through and full of leeches, so that I preferred my wet but warm clothes to the wet and cold blankets. It was a miserable night; the leeches alone were sufficient to put sleep out of the question, but when backed up by an army of red ants, which had been disturbed by the camp, the combination, along with the state of the weather, was at once irritating and depressing. As soon as day broke, we commenced the last ascent of the Mōnōrōn range, found a narrow pass which took us through to the other side, struck the Klaung Dan Lēk, a tributary of the Mōnōrōn river, and followed it down to its junction with that river through much the same sort of jungle as in the previous march. An early halt was called on the right bank, another hut built, and everything put out to dry in the hot afternoon sun. Next day this river was followed down-stream to Mōnōrōn village, or rather to a part of it. The word "village," as used in the district, is rather misleading. When you are told there is a village at a certain place, you expect at least to find a row of houses, but these expectations are doomed to disappointment.

This particular village consists of about seventy huts, spread over fifteen miles of river bank in clusters of one, two, or three. Each group of huts has its own little clearing of paddy fields, and shifts its site annually, so that the whereabouts of the village is more or less doubtful. There is a head-man nominated for about every ten huts, and he is called a "ten-house *Gaung*." Over these ten-house Gaungs there is a village head-man or *Youh-Thugee*. The group of huts at which I halted was at the highest point of the river at which the tide is felt, and to which I found it navigable by boats. I had to wait there for my boat, which I had sent round from the highest navigable point of the Little Tenasserim river, *viâ* Tenasserim, Mergui, the archipelago, and the Legnya river. I was also compelled to halt longer than was necessary for this purpose, till some of my men recovered from swollen groins brought on by leech bites on the ankles and legs. From Mōnōrōn village the boat was sent down to the junction of the Legnya river, and then up that river to Legnya village, which was the next point I was making for. The Mōnōrōn river, running from east to west, meets the Legnya river, and both flow together into the sea at Whale bay, which is east of Kyauk-pyoo island. Various streams appear, as far as I could ascertain, to have been called the Mōnōrōn river at various times. This is presumably owing to the moving of the village from time to time. The Legnya river runs roughly from south to north and rises close to the source of the Packchan river, flowing from north to south, at about 10° 45′ N.

The village of Legnya is thirty-six miles up from the mouth of the river and eighteen miles above the junction of the Legnya and Mōnōrōn rivers. The river at Legnya is 260 yards wide, and is navigable by small coasting steamers to the village. I say it is navigable, for the British India s.s. *Mergui* once ascended to this point, but I believe that is the only time the passage has been made.

I found my boat had arrived here just a few hours before me, and I made use of it during the next few days, trying to reach my line of march by the various tidal creeks which I had crossed. In most of these creeks both masts had to be unstepped to avoid striking the trees which met overhead, and a certain swamping if they did. Sweeps could seldom be used, but, unless to accelerate the pace, they were fortunately unnecessary, as the tide was sufficient to carry one up, except when a snag of palm roots and tree trunks had to be broken up. There is a rapid in the Legnya river which can only be passed at certain stages of the tide, and several whirlpools, which are a source of considerable danger to small craft and inexperienced boatmen. The latter are fortunately almost an unknown quantity.

At the mouth of the Legnya river I saw, or rather had a closer inspection than usual of, the method of fishing which is carried out in this district. A large net is supported by a bamboo frame-work with a platform on the top for the fishermen to work it from. Two rows of bamboos, planted in the bottom and wide apart at the far end, converge on to the net. When the tide is up, the force of the current makes these bamboos wave and vibrate in the water. The fish, getting in at the wide end of this "lead," and fearing to pass between the swaying rods, follow up one side or the other till they reach the net, which has been already lowered. When sufficient fish are in the trap, the men on the platform have merely to lift the net by a rough mechanical contrivance, sometimes by levers and sometimes by pulleys, and take the fish out at their leisure.

From Legnya I struck coastwards, across the Chaung Moung, a tributary of the Legnya river, and the Yegnan, a stream running into the sea north of Bokpyin, for Bokpyin itself. There had once been a jungle-path across this piece of country, but it had been almost obliterated by the rapid growth of vegetation, and rendered impracticable in places by elephants, rhino, and pig. The journey through the jungle from Legnya to Bokpyin takes three days. With a favourable wind, and by accommodating oneself to the tides, it can be accomplished in the same time by water. The latter method consequently appeals to the natives of the district as the easiest mode of progression, and, time with them being no object, is the one invariably adopted. I camped on the banks of both the Chaung Moung and the Yegnan, to see how far up towards my line of march each was navigable. The former was found impracticable at that season from its junction with the Legnya river, but by the help of some blasting could be used by boats up to the line of march. The latter, in its branch known as the Klong-ka-tōn, was found navigable up to a rocky barrier just on the line of march by a boat carrying 100 baskets of rice, or 5600 lbs.

The forest in this part of the country is composed entirely of bamboo,

and the country itself is hilly, but not mountainous as shown in existing maps. There is no large range of hills between Bokpyin and Legnya, and the ascent and descent of the watershed between the two valleys are scarcely perceptible. The Bokpyin river runs into the sea east of Malcolm island. There is a small island called Silver island three miles from the village of Outer Bokpyin, which is at the mouth of the river, and there is another village, known as Inner Bokpyin, five miles farther up-stream, which medium-sized boats can reach with a flowing tide. Small coasting steamers, owned and manned by Chinamen, occasionally stop off Silver island to pick up any one who comes out by boat and wishes to go towards the Straits or Mergui. If, after one hour's wait, there are no signs of a boat, the steamer goes on. It cannot approach closer on account of mud banks.

Outer Bokpyin is one of the very few places where one may occasionally see specimens of that extraordinary race known as the Salones. They are a people peculiar to the Mergui Archipelago, and their origin is apparently doubtful. The opinions of various persons who have studied them differ considerably, but the prevailing one is that they are an outcast Malayan tribe who were driven out of the Malay peninsula and took refuge in these islands. Their language, though different from all others, contains a few words with meanings corresponding to similar words in Malay. They have no fixed abodes, but live principally in boats, moving from place to place as occasion demands. They dive for pearl oysters, search for sea-slugs, shell-fish, and turtle eggs. Their staple articles of food are fish, jungle pig, and occasionally small deer; the former are caught by themselves, and the latter two by their dogs. The women make a peculiar kind of matting, which is bartered to passing boats for the few pieces of cloth they clothe themselves with, and other things which Nature does not provide. They are still perfect barbarians, and until quite lately would run away and hide at the sight of a stranger. The pearlers being now at work in the archipelago in which they live, they are gradually growing accustomed to contact with the outside world, and a few very occasionally venture to the mainland.

From Bokpyin I marched down the coast to Karathuri, halting on the Chaung Pi and the San Chaung. The sand-flies on these creeks are very troublesome. I used to build a small hut, wall and thatch it, just leaving a hole to get in at, and hang a mosquito net inside when the whole was finished, but I could not keep them out. The hut, however, made a very fair protection against the fogs, and did not take long to erect with the help of a few coolies.

One is often apt, after a tiresome march, to shirk the extra work of roofing, but both time and trouble are well spent. Fever may not make itself felt at the time, but exposure to the fogs means saturation with malaria, and the day of reckoning will come sooner or later. The country between Bokpyin and Karathuri, lying between the coast and the hills, is very much intersected by creeks and streams. The immediate vicinity of tidal creeks is always mangrove swamp, and that of fresh-water streams a marsh. Just before reaching Karathuri there is a small village called Kyauk-Kyi-Chaung, on a creek of that name, where

A KARATHURI MINER AND HIS PIPE.

A JUNGLE VILLAGE.

TIN-WASHING.

WINNOWING PADDY.

The grain is shaken through a sifter by a woman standing on the top platform. The grain falls through the bamboo floor and is received on mats below. The chaff is carried away by the slightest breath of air and falls wide.

a few Chinamen do tin-washing on a small scale. Karathuri village is entirely inhabited by Chinamen who also wash tin, but on a larger scale than at Kyauk-Kyi-Chaung.

There are many places in South Tenasserim where tin is found, and it is worked principally by Chinamen. No very great success has attended their efforts up to date. The fact that the ore is got in however small quantities in so many places in the district, with the aid of only native mechanical appliances, points to the probability that considerable mineral wealth would be found by systematic and thorough prospecting. The Chinamen only work the stream tin, and leave entirely untouched the granite in which tin-stone occurs. There are several obstacles which strike the casual traveller in the district, and which must be eliminated before success can be attained. There are no means of communication by land, and those by water are slow and at times impracticable. There is a want of capital, and consequently insufficient outlay in appliances. The working of the tin depends entirely on the water supply, and this fails for several months in the year. Of local labour there is practically none, and the difficulties and expense of importing it are great. The small population in the district is mainly Siamese, and they are naturally averse to work and are addicted to drink. Most of the labour is imported from China. The work is hard and the hours long while work lasts. The pay is not excessive, and the money actually paid over by miners to their coolies generally finds its way back to the employer's pocket through the medium of a gambling-house financed by the latter. Gambling appeals to all Chinamen, and they will play till they have nothing left to stake. The deposits at present being worked by the Karathuri men lie half a mile beyond the village, along a line parallel to, but not in sight of, the coast.

Two miles farther on there are a few houses at the head of the Chaung-Pi-Pia, and these were the last signs of life I saw on the coast. Continuing still down the coast, I reached the site of the deserted village of Chaung-Ta-Naung, and from that point had to turn inland again, as the coast-line could no longer be followed. The only natural guide remaining was the Plygnan river, which is one of the streams which combine to form the Packchan. By striking east from Chaung-Ta-Naung I knew I must get to the Plygnan or one of its tributaries near the source, and I could then follow it down-stream till I should reach Lompaw, the most northerly village on the Packchan in British territory. The distance from Karathuri to Lompaw being about thirty miles, I calculated on traversing it in three days, and rationed myself and party accordingly. We did not arrive at Lompaw till late on the fifth night out. The country is quite unknown, and I could find no one who had been across, or who could give me any information. After crossing the range of hills which runs down the coast of Chaung-Ta-Naung, I was fortunate in hitting on the source of the Plygnan itself. This river is known to natives as the Chaung-Gnan, except towards its source; *Ply* means "head of." There was little difficulty in reaching the top of the Chaung-Ta-Naung range, but the descent on the east side was not easy, as a way had to be cut through the undergrowth step by step.

As soon as water was reached, the Chinese coolies whom I had taken from Karathuri struck work, refused to go another step, and in ten minutes were all under blankets smoking opium. Not being far enough from their home to assert myself, I thought it advisable not to argue with them, and, making a virtue of necessity, built a hut for the night. From that camp onwards for four days we had, when it was possible, to wade down the bed of the Plygnan, and when it was not, to cut through the jungle. As long as the Plygnan was sufficiently small and shallow, scrambling along the bed was found more expeditious, but it runs throughout its course through narrow gorges, and deep pools compelled us to take to the jungle.

During the second day out from Karathuri we managed to get over only five and a half miles in seven and a quarter hours' marching. By this time it was evident that Lompaw would not be reached before the rations gave out, unless we were very careful. I tried to make the coolies realise this fact, but it was hard work. They talked only Chinese, the police-guard talked only Burmese and Karen, and I talked only Hindustani, a little Burmese, and less Shan. After much talking and gesticulation by everybody, the idea seemed to dawn on them, but the advice was unheeded. They preferred to live well, as Chinamen generally do, while they could, and stand by the result. The next march was a repetition of the last, except that we got over eight miles in eight and a quarter hours' marching, passing the Banhuni river, which flows into the Plygnan on the right bank, and reaching the Klong Kra junction before dusk. We halted in the fork at the junction of the Klong Kra and Plygnan. I had reckoned this point to be about half way between Karathuri and Lompaw, and the coolies finished their rations that night From here the Klong Kra and the Plygnan flow together as the Packchan river, which is the British-Siamese frontier. Crossing to the right bank of the Packchan at the junction, so as to keep within British territory, I continued down that bank all next day and got through five and a fifth miles in eight and a fifth hours' marching. The coolies were pretty well done up when we halted at night, as they had had no food that morning and had none to eat now. I had just sufficient left for a small meal and something over for the morning, so could not help them at all. When darkness set in, they lighted some bamboo torches and tried burning the water—that is, holding the torch close to the surface of the stream, they waiting with uplifted *dah* (knife) to slash at any fish the light might attract. This was not attended with success, as the stream was too deep to stand in, and the banks too steep to wield a *dah* from with any degree of accuracy. They had nothing but their opium, and I think began to regret having gone on strike the first day out. What with wading and falling over submerged rocks and into holes in the river bed, all the baggage was pretty wet, and we had no matches dry enough to light a fire; but here the Karen police came to the rescue. They made fire by friction in a way I had never seen or heard of before. One of them got a short length of bamboo, very old and dry, about eighteen inches long. This he cut into two pieces longitudinally. A bamboo being made up of a series of cylinders, he had then two troughs with a semi-circular section.

He then cut two forked sticks about the same size and shape as a catapult stick, only with longer handles. These two sticks he planted in the ground, fork upwards, about twelve inches apart. He then laid one of the two sections of bamboo across these forks. Having made it fairly firm, he scraped all the dry powder and fluff with which a dry bamboo is lined into the hollow of the second piece, and laid a piece of dry leaf on the top. Then taking this second piece, one extremity in each hand, hollow side up, he rubbed its smooth outer surface very quickly and sharply along the upturned edges of the first, that lay on the forks, taking care to make the friction immediately under the dry leaf. In, I should say, slightly over half a minute, sufficient heat was generated to produce a glow in the fluff, which quickly communicated itself to the leaf and was then blown into a flame. By this method you get a light speedily, and with little exertion, provided you take an old and very dry bamboo, and of such we had more than enough.

Between this camp and Lompaw the river takes several large bends, and as it was imperative that we should reach Lompaw that day, I decided, though with grave misgivings, to make a straight line for it with the compass. For about two miles we followed this line with difficulty, cutting each step, until I saw it would be impossible to reach Lompaw that way, so turned east to regain the river. As luck would have it, the new line took me over a very high range of hills, and before the river was reached the coolies were completely exhausted with hunger and fatigue. On reaching the river, the only thing left to be done was to build bamboo rafts and float the whole party down. Lompaw was at most only five miles away, but it was now past midday, and from former experience I knew that five miles might be a full day's work for strong men. The police cut and dragged the bamboos to the river, and as each raft sufficient to carry four men was tied up, it was sent off. The men were given to understand that the first raft in to Lompaw was to send back canoes and food from the village. The canoes came up all right, but as each successive raft which they met on the way looted some food, there was not much left when they arrived, and a free fight for the remainder commenced among the coolies, which was stopped with some difficulty, as the weapons were various and far from modern. This stretch of river which I canoed over, I marched along afterwards, and came to the conclusion that it was well I decided to make rafts when I did, or some of the coolies might have been left there for good. The Chinese coolies I had with me were all imported to Karathuri for tin-washing purposes under an advance of wages, extending up to one year or less, according to arrangement. Some of them had been newly imported when I hired them, and now found themselves with their advance in their pockets, and the Siamese frontier beside them. The temptation was too great for three of them, and they bolted, but were tracked down by two Siamese trackers and brought back ultimately to Karathuri, their masters, and punishment. The last consisted in being tied up to a tree and beaten with an iron rod about one-third of an inch in diameter. The result was one man dead, one broken-armed, and the third very sorry for himself. The Chinaman who perpetrated this cruelty soon

came to the conclusion that Burma would not be a healthy place for him to stay in any longer, and made a bee-line for Siam also. Even in those entirely out-of-the-way corners, they recognise that the arm of the law, though slow, is very far-reaching.

The country between Karathuri and Lompaw was the most difficult part of the march up to that time. There is a total absence of even a pretence of a path or track. The jungle and undergrowth is particularly dense and hard to get through, being largely composed of thorns and cane. Heavy bamboo covers hillsides and valleys alike, and the timber is high and of good girth. One is seldom exposed to the sun, even when in the river-bed, as the Plygnan and Packchan up to Lompaw flow through narrow gorges covered with overhanging timber. The country is full of big game, and the rivers swarm with splendid fish. The trees, at the time of year I went through (February), were covered with orchids in flower. One never gets an extensive view, but the scenery that meets the eye is always pleasing, and the stillness is intense. This is one side of the picture, and the pleasant one. There is another. The jungle is alive with snakes, the dead foliage underfoot is full of leeches, the soil teems with myriads of ants more or less vicious, and the atmosphere is unhealthy.

Having reached Lompaw and waited till my boat arrived from Karathuri *viâ* the Packchan river, I had nothing to do but follow that river, if possible, to the sea at Victoria point, a distance by land of about 67 miles. The first place I made for was Kikafoi, the most northerly outpost we have on the Packchan river, garrisoned by a detachment of Karen military police. Between these two places the river could be closely followed, as the right bank has groups of huts built along it at intervals and much of the land is under paddy cultivation. The villages of Packchan, Nalingchan, Nam Nwe, Pauset, and Tankaprit were passed through in succession, every component group of each village having its own patch of cultivation and fruit-trees.

A range of hills runs more or less parallel to the Packchan river, at a varying distance from it, right down to Victoria point. Between this range and the river the country is open and cultivated, undulating, and covered with scrub jungle. High spring-tides are felt a short distance above Lompaw, and it was with difficulty I managed to get my boat to Lompaw itself. Large boats can reach the village of Pauset with neap tides. The only village of any importance between Kikafoi and Victoria point is Malewun, and to reach it was the next object. Here, again, we were compelled to leave the river and make a detour inland to avoid the mangrove swamps bordering the Klong Kamu Dien and Klong Kamu Yei, two tributaries of the Packchan in British Burma. Below Kikafoi village, which covers a large area, there is the village of Bansonpan, on the Bansonpan creek. This creek divides into two, which are called respectively the Bansonpan Prequa and Bansonpan Presai creeks; *Prequa* and *Presai* being the Siamese for right hand and left hand. They are on the right and left hand looking up the main creek from the mouth towards the junction. All the huts and cultivated fields between the two branching creeks constitute Bansonpan village, and all north of

the Prequa creek constitute Kikafoi village. Striking gradually inland, we crossed the Prequa creek, passed the Bansonpan village, and halted for the night on the banks of the Presai creek. The jungle at this camp was so very thickly covered with rank vegetation and so full of leeches that I built my hut over the creek itself, at a shallow place. From the Presai creek at Bansonpan on to the Malewun tin-workings, the jungle is almost as thick and heavy as between Karathuri and Lompaw, and was most difficult to get through. Another night was spent on the banks of the Klong Pa Hom, a tributary of the Klong Kamu Yei, and a most unpleasant one it was. Being fairly tired, and not having halted till darkness had quite set in, which is a mistake, I was too lazy to build a complete hut. After looking round for a bit, I found four young trees about one foot each in girth and pretty symmetrically placed, which I thought would answer admirably for corner posts, and I used them as such. I had not completed the platform and roof and lain down many minutes when I found that each tree was a main thoroughfare for sections of a large army of ants—the big, red, and pugnacious variety. Investigation showed that they were coming up from below; so I lit four small fires round the foot of each tree, shook the bedding, and lay down again, perfectly satisfied that I had defeated them. Four fires underneath you are not pleasant, but are sometimes necessary. By and by the ants which had already got up began to come down again to see what had gone wrong with their plans; they are very methodical. This movement I did not take long to discover, for ants bite hard and leave a lump behind. This time I had to get a large *dah* and cut the four trees down just above the ridge of my roof; I stirred up the fires, and tried to sleep again with a certain amount of confidence. But it was misplaced. Enough of the insects had got into the thatch and the bedding, and the blankets and the bamboos, to make themselves disagreeable. I could not get on to the ground to hunt them, as my legs would only have made two more ladders for them, so I had to sit in each corner successively and *shikar* (hunt) them one by one. Sport, scenery, and rare orchids hardly compensate one for such trials.

From the Klong Pa Hom to Malewun tin-mines the jungle remains thick, but the two miles from the tin-mines to the village of Malewun are free of jungle, the country is undulating, and there are almost two miles of cart road. At Malewun there is another outpost garrisoned by Karen military police, and at Victoria point a third. From Malewun to Victoria point the country is fairly open, there are fragments of paths between the villages, and the 25¼ miles were easily done in one day's march. Arriving there towards dusk, I was fortunate in finding Mr. Parry, the Assistant Commissioner and only European officer south of Mergui, at home. Dressed in a battered hat, a dirty coat, tattered Shan trousers, and all that was left of a pair of ammunition boots and *puttees*, and with a two months' old beard, I was hardly recognisable.

Victoria point, or Pulo Dua, consists of a few bamboo huts at the extremity of the peninsula formed by the ocean and the Packchan river, built under a clump of cocoa-nut trees, and inhabited by Malays. On the top of the hill which forms the point there are the military police

barracks, the houses of the assistant commissioner, *myook* (magistrate), and civil police subordinate.

There is also a hospital: I believe there are bottles inside it, but there is nothing inside them, and no doctor, or even hospital assistant, to look after any one who is unfortunate enough to fall ill; the nearest doctor is at Mergui. During the cool and hot seasons the wind is contrary, and the journey by country boat may take any time up to fourteen days. During the monsoon the wind is favourable in direction, but no country boat dare put out. The only thing one can put any reliance on is a small coasting steamer run by Chinamen, which plies between Tavoy and Penang, and calls at Victoria point roughly every six weeks.

The scenery at the point is exquisite, but one can neither talk to, nor live on, scenery, and an unbroken year at a station such as this is would be sufficient to drive the most hard-headed man distracted. In front and on the right there is the sea, on the left the Packchan river with mangrove swamps, and behind the jungle.

While waiting for the Chinese boat, Mr. Parry took me over to the Siamese State of Renoung, on the left bank of the Packchan river, opposite Victoria point. This State is ruled by a Chinese Governor, who has a most palatial residence just outside the town. He speaks English fluently, and shows the greatest hospitality to any Englishman who visits his State.

On one of the hills overlooking the town stands a splendid palace, the building, furnishing, and laying out of which must have cost an immense sum of money. It was built for the King of Siam on the occasion of his paying a visit to the State. He occupied it for four or five days and then left, but, according to Siamese custom, any house occupied by the king can never be occupied by any one else, and so this beautiful building is rapidly falling into decay. A little lower down the hill there is what was once a very pretty bungalow in much the same state of ruin, which was built for one of the princes.

Gambling, which is prohibited on the British side of the Packchan, is carried on here to a great extent. There is a large gaming-house in the town which opens at a certain hour every evening, and to which all can go.

A few days after our return to Victoria point the Chinese boat was signalled—the signal consists of a general shout by the Karen guard as soon as she is sighted; every one can hear it—and both Mr. Parry and myself said good-bye to the place without a sigh of regret, and with a fervent hope we might never go back. There may be worse places; but I doubt it.

RECENT HYDROGRAPHIC RESEARCH IN THE NORTH AND BALTIC SEAS.

(*Continued from page* 425.)

The Skagerack and Kattegat in November 1893. Results of International Research in the North Sea at that season.

THE principal change, then, in the Skagerack between August and November consisted in the substitution at the surface of bank water in the place of the Baltic current, which during autumn diminishes to a coastal stream. At first the bank water appears as an under stream hugging the Jutland coast, but as early as September it has spread itself over the whole southern and western parts of the Skagerack, while the northern and eastern parts are covered with Baltic water, and the bank water can approach the banks on this side only as an under current. In autumn 1893 it penetrated at length over the banks and within the fringe of rocks on the Bohuslän coast, bringing with it the winter herring, and then its expansion was at its greatest, the northern bank water being in full flow. Meanwhile the stream vanished from along the coast of Jutland, and a narrow belt of $34°/_{oo}$ water appeared in its place. These lines of flow were developed in August and September when the bank water began to appear in the Kattegat and the drift-net fishing was being pursued. The fishery was most productive in September, and came to an end on October 7th, after which a short interval intervened before the winter fishery came in, which occurred in November. The circumstance that the inflow of the bank water off the Jutland reef ceased in November is important, as it shows the beginning of those changes which end in the restriction of the bank water on the surface to the Norwegian coast, as seen in February charts, an arrangement that betokens the last phase of the inflow of bank water and the end of the winter herring fishery, at least in a normal season such as 1893-94.

When the northern bank water, with its lower temperature, begins to enter the Skagerack, the channels of the Kattegat are already filled with warmer water of the same salinity, and therefore the later inflow does not pass on into the Kattegat but runs directly to the bank and fiords of Bohuslän, so that a striking difference arises between the volume and temperature of the bank water in the two seas.

The arrival of the southern bank water in autumn causes very marked changes in the plankton along the coast of Bohuslän. Animal forms never seen elsewhere on the Swedish coast then appear, and after a short time vanish. These forms occur in the southern North Sea, the British Channel, and the Biscay coves, and are doubtless introduced by the southern bank water current. Meanwhile the Baltic coasts retain their own plankton, though more and more mixed with *Diatomacea*, which are rare in summer, and plankton of quite a different character is found in the open Skagerack where the bank water reaches the surface.

Below the bank water is a layer of $34°/_{oo}$ water, which at this time

is the warmest in the Skagerack, with a temperature of 9° to 10° C. As before remarked, its temperature varies inversely with that of the seasons, and accordingly in August and September 1893 it was found to be rising in temperature. The differences were small, but, at least on the C line across the Skagerack, very perceptible at all stations.

Soundings at station C_{iii} showed that no bank water existed here at the beginning of August, whereas by the middle of November it had attained a depth of 25 to 30 mètres, both the 34 and 35 °/₀₀ waters having sunk to a lower level. The reason, no doubt, is that the Baltic stream, running out strongly during summer, draws in the bank water below. In this month, as the Baltic stream fails, this reaction diminishes in the lowest layers, and an inflow from the North Sea and Atlantic of the continental coast waters prevails. Below this bank water often comes a fresh supply of 34 °/₀₀ water with a higher temperature than the summer 34 °/₀₀ water. Small as the temperature difference is, it is still enough, owing to the great changes in the surface layer, to render the 34 water the warmest water in the Skagerack, instead of the coldest, as it is in summer. That it was a new 34 water which entered in November appears from the quantity of gas it contained, and the difference is so great that the November water probably originated in a different part of the sea from the August water. Both at station C_{iii} and at S_{vii}, 40 miles east-north-east, a considerable supersaturation with oxygen was apparent in August, the percentage being abnormally high, 36 to 37, while the carbonic acid amounted to only about 45 to 46 cc., and the nitrogen to 13½ cc. and over, corresponding to an absorption temperature of 4° to 5° C. *In situ* the water had a much higher temperature of about 7° to 9° C. These data indicate that the August water was derived from some part of the northern seas where abundant vegetable plankton was floating on the surface. Probably this tract was at some distance northwards, for the water must have travelled a considerable time below the surface and risen in temperature on its way to the Skagerack.

The November water exhibited very different properties. It had a temperature of 9·8° to 10° C., a quantity of oxygen somewhat below the normal (about 32·6 °/₀), and 12·2 to 12·3 cc. of nitrogen, which it had absorbed at about 9° C. The carbonic acid was larger in amount (about 47 cc.). The nearest spot where water of this character occurs in summer is the sea south of Iceland. In October 1892 R. Sohlman found the limits of 34 water between 34° and 54° W. long. and at 57° lat. There the water had a temperature of 9° to 11° C. The salinity, 34 °/₀₀, is in general characteristic of the West Atlantic area between the branches of the Gulf Stream, which carry the saltest water of over 35 °/₀₀, and the border of the Polar stream, where 32 and 33 °/₀₀ water is found. At first it seems incredible that the warmest water of the Skagerack in winter should come from the western side of the Atlantic, but it was found that similar 34 water underlying the bank water in December 1896 contained *tricho*-plankton, which belongs to the West Atlantic area. To understand how such water crosses the branches of the Gulf Stream, which contain salter water, the results of Mr. Dickson's

and Dr. J. Hjort's investigations in November 1893 must be consulted.[1] The bank water, always a surface water in the North Sea, lay along the coast of Norway, as already described. Across the North Sea plateau, from the Shetlands towards the south-east, stretched, as usual, a broad area of Gulf Stream water of high salinity. At a depth of 50 metres this area was divided into two, and the surprising discovery was made that the Gulf Stream water entered the North Sea in November in two branches, which flowed together at the surface, but below were separated by a wedge of 34 water from the Western Atlantic. This is the formation which causes the singular irregularities at the edge of the 32 and 35 waters on the western side of the Norwegian deep channel. The three streams flow across the North Sea plateau, and, pouring into the deep channel, find their way to the Skagerack. At Mr. Dickson's station ix., east of the Shetlands, the surface water had a salinity of 35‰, with a temperature of 8·9° C., while at the bottom was found water of 34·63° salinity, with a temperature of 9·2° C. The salinity was determined by analysis, and the specific gravity, ascertained by Sprengel tubes, was $S\frac{15}{4} = 1{\cdot}02575$, so that it can be affirmed with absolute certainty that 34 water under the salter layer flows with it southwards, and forms the intermediate layer in the Norske Rende section.[2] The vertical arrangement on the east of the Shetlands cannot, however, be stable, for the temperature in the lower layers is somewhat higher than in the upper, while the salinity is lower, wherefore the phenomenon cannot be a consequence of the movement of the waters. At any rate all the circumstances prove that the 34 water from the west passes the Gulf Stream, for in the following November (1894) there was the same formation on the North Sea plateau, namely, two tongues of 35 water separated by a broad tongue of 34 water, but in this season the latter rose to the surface. This year also the bank water entered on the northern side of the northern arm of the Gulf water current, but in a much smaller belt than in 1893, the Baltic water lying off the coast in a deep layer. It is worthy of remark that in the Norwegian spring herring district, which is situated here, the fish wintered in large numbers, as in November 1893, but failed in following winter (1895).

The bank water, as far as it has been followed, comes from the north, and is clearly distinguishable from the 34 water. It is very singular that in 1893 it did not flow farther than the Skagerack. As discovered in 1896, there are years when it does not stop here, but flows southwards past the mouth of the Skagerack. It should be mentioned that, as the arrival of the bank water is intimately connected with the herring fishery, when this water extends farther than the Skagerack the fishery is subject to peculiar variations. The winter 1893-94 may be considered a normal season as far as the Skagerack herring fishery is concerned.

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[1] *Twelfth Annual Report of the Fishery Board for Scotland*, part iii. *Hydrographic-biological Studies of the Norwegian Fisheries*, by Dr. Johan Hjort. Christiania, 1896.

[2] See Plate III. in Dr. Hjort's *Studies*.

The Condition of the Skagerack in February 1894. Changes in the North Atlantic, May 1893 to Feb. 1894.

In February 1894 the masses of bank water, which in November of the preceding year stretched from the Skagerack up northwards to the 62nd parallel, were confined to the Skagerack and the Norwegian spring herring district between the Hardanger and Stavanger. It was surrounded by 34 water, which usually enters the Skagerack in the spring and early summer, but appears to have arrived somewhat earlier this year. The season of the 35 water is rather later. In February 1894 the bank water was not present in the southern part of the North Sea, and it is, therefore, northern bank water that at this season predominates in the Skagerack and Norwegian fishing-grounds. Its temperature is then at its lowest, 3·7° to 4·6° C., and the underlying and adjacent 34 water has a low temperature of about 5° C., which it retains throughout the summer. The great fall of temperature in this water from November to February and in the spring months shows that it has cooled down in winter on the surface of the North Sea, and that it is Atlantic surface water which contains the temperature minimum in the Skagerack during spring and summer. Further evidence of this view is afforded by the large quantity of nitrogen the water contains, even at its low temperature in summer, whereas the November 34 water has a smaller amount of nitrogen and a higher temperature. Hence the 34 water in the Skagerack consists in the early part of the year of winter surface water from the North Atlantic, but in the latter part of the year (from August onwards) of West Atlantic summer water, which makes its way across the branches of the Gulf Stream. Of precisely similar character was the 34 water which was found in great volume below the thin layer of bank water in Dec. 1896. As, then, the annual variations of temperature in this water are explained by its origin in distant parts of the ocean, the term North Sea water is no longer appropriate, and therefore the authors style it simply 34 water, leaving the choice of a particular name open till such time as its exact source may be definitely ascertained.

Storms prevented the line, Vinga to Ö. Risör, from being sounded in February, and on this side only a line from the interior of the Gullmar fiord to about 18 to 20 miles west of Lysekil could be observed, which, with a section from the Skaw to Christiansand, exhibited the conditions in this month. The bank water was not only restricted in area, but also much reduced in depth, the 34 water beginning to rise up. On the coast banks, however, and in the fiords, it was still of considerable depth, and the circumstances between the Hardanger and Stavanger were similar. The bank water seems to have been forced by the westerly storms against the coasts of Norway and Bohuslän. At both places the shoals of herring were abundant, and, as usual when the bank water is at a high level on the coasts, seine fishing was pursued in the fiords, but the stormy weather interfered with it along the outer line of rocks on the Norwegian coast. Dr. Hjort's observations show that the

fishing season came to an end in April, when the bank water was covered by the outflow of the Baltic water.

The autumn of 1893 and the winter following are the periods in which hydrographic research in the North Sea area has been most extensively carried out, and the whole sequence of changes that took place is fully revealed by the hydrographers of the surrounding countries. In the latter end of May and in June there was a strong outflow of Baltic water which covered the Skagerack and the Norwegian deep channel, while 35 water from the northern part of the North Sea streamed into the lower depths. Between lay 34 water at a temperature of 6° to 7°, which in summer passed from the Skagerack into the Kattegat. Bank water of 32 and 33‰ was entirely absent from the centre of the Skagerack, where the Baltic water lay immediately above the 34 water, and was only found below the surface on the coast banks and in the fiords, where it had remained from the preceding winter.

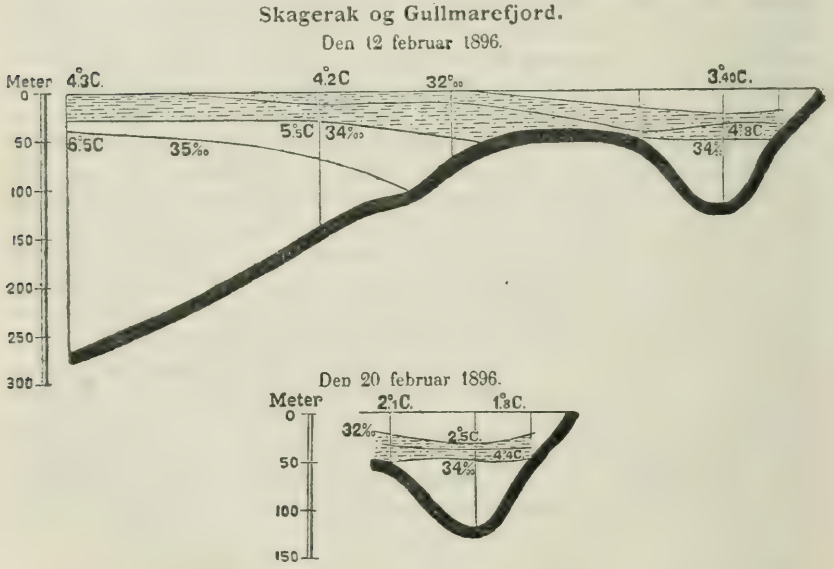
In the early autumn months the Baltic stream began to show signs of failing, and a new kind of water from the Atlantic began to make its way into the Skagerack. No doubt this occurred because the enclosed North Atlantic basin—the Norwegian and Arctic seas—are in summer filled with water from rivers and the melting of the snows, which at that time was not thoroughly dispersed, so that, when one of the sources of supply, the Baltic current, began to diminish, there began a counter movement towards the Skagerack of the continental coast water (bank water) which at this season is quite warm. The first inflow, of southern bank water, passed along the Jutland coast and entered the Kattegat, supplying warm water to the deeper parts throughout the autumn. In this water the drift-net herring fishery was carried on between Anholt and Vinga from Aug. 16th to Oct. 16th. In September, October, and November the Baltic stream dwindled more and more, and the bank water current became more voluminous, water from the northern part of the North Sea entering the Skagerack, and in the last month spreading over the surface. The northern bank water in 1893 proceeded no farther than the Skagerack, and did not extend to the southern shores of the North Sea. The plankton in the southern bank water was such as occurs in the British Channel and the Atlantic coasts, while that brought in by the northern bank water was partly *Didymus* plankton, in which *Diatomacea* were very abundant at the surface 12 miles west of Lysekil, and partly pure Atlantic *tricho*-plankton. The presence of the former kind has already been explained by the inflow at this season of 34 water of higher temperature (8° to 10° C.) than is found there in summer.

The Skagerack in the middle of February 1896.

As storms prevented a thorough investigation of this sea in February 1894, the Swedish Hydrographic Commission organised an expedition in February 1896, to obtain a complete knowledge of the Skagerack's winter state, in conjunction with the investigations on the Atlantic coast of Norway and those of the Danish hydrographers in the Kattegat. The

winter 1895-96 was mild, like that of 1893-94, and the conditions in February were much the same in 1894 and 1896. After a long stormy period a few weeks of complete calm occurred, so that the expedition could carry out its work with the greatest precision. According to the plan of the Commission, a biological examination of the plankton of the sea was one of the chief objects of the expedition, and this was in the hands of Professor P. T. Cleve and Dr. C. Aurivillius. By a thorough comparative study both of the plankton that appears during the course of the year on the west coast of Sweden and in the Skagerack, and of organisms collected from all tracts of the North Atlantic from Baffin's Bay to Bermuda, and from the north of the Baltic to the British Channel, as well as off Iceland and Greenland, these naturalists have succeeded in identifying the plankton of the Skagerack with forms characterising various regions of the North Atlantic. The results have been published in special treatises.

In February 1896 the northern bank water was predominant on the surface of the Skagerack, and all connection between it and the southern North Sea coast water was cut off by 34 water, which this winter seems to have flowed in in large volume, partly beside, partly below, the bank water, through which it rose to the surface west of the Väderöar. The



Baltic water was only a narrow coast stream covering the bank water, which in a deep layer and at a high level lay against the Swedish and Norwegian banks. The herring fishery in Bohuslän with seine and moored net was coming to an end by the middle of the month, for the bank water after the stormy period began to withdraw to the middle of the Skagerack. The expedition sounded a line from the Gullmar fiord

westwards twice during the month. On February 12th a layer of bank water at 4·8° C. was found in the fiord and on the coast below the fresher Baltic water. The shoals of herrings kept to the deeper parts of the fiord during the day, and at night swam up the inlets. Eight days later, on Feb. 20th, the bank water had become much thinner, and was retiring. Its place was taken by the fresher surface water, which had become colder (1·8° C.). The shoals had mostly left the fiord, and were found in the central parts of the Skagerack, where bank water of 4° to 5° C. still remained on the surface. On three nights, when the expedition was at work in the open sea, the vessel was surrounded by shoals migrating from the Bohus coast, and by the electric light it could be seen that the fish were smaller than those found farther north. They belonged to the smaller variety that frequents the southern Bohus coast in winter, while the latter come from the Norwegian coast.

In the stationary waters of the Gullmar fiord, below 40 mètres, which harbour shoals of herring and also of cod and saith, which come there in the wake of the herrings, the action of animal life was apparent in the chemical analysis. The extremely low percentage of oxygen, only about two-thirds of the normal, together with the unusually large proportion of carbonic acid, could only be a consequence of the animal life which abounds at these levels in the fiord, where the fishery had been most productive during the winter. Outside the fiord very different conditions prevailed, as was shown by soundings 12 miles west of Lysekil. Here the same kind of water (33 and 34), which within the fiord had lost a third of its oxygen, was supersaturated with oxygen (7·2 cc., or 34·2 per cent., instead of 3·96 cc., or 22·9 per cent.), and the quantity of carbonic acid, which at 60 mètres within the fiord was 49·67 cc., was only 47·76 cc. outside at the same depth. And the waters in other parts of the Skagerack on the one hand, and in other fiords on the other, were similarly different.

Both the bank water and the underlying 34 water in February 1896 were, then, well ventilated, and both were of northern origin, as shown by their large amount of nitrogen, 13·6 to 14·1 cc., which corresponds to an absorption temperature of 3° to 3·5° C., as well as by their plankton, which consisted of West Atlantic and Arctic animal and vegetable forms. The former were predominant in 34 water, and the Arctic types in the 33 water, notably at Anholt and Kullen in the Kattegat and at Bornholm. Probably the Arctic *Diatomacea* follow the bank water under current into the Kattegat, and there rise to the surface.

In some of the fiords the oxygen is entirely used up. This was found to be the case in the Borghila fiord, which is cut off from the sea by a bar 25 mètres below the surface. Below this depth the water is so stagnant that it is quite homogeneous as regards temperature, salinity, and nitrogen. With a complete absence of oxygen there is also an enormous quantity of carbonic acid, 50 cc. per litre. It would be exceedingly interesting to repeat soundings in this fiord, to find out whether the oxygen is always absent, and ascertain whether the water below the level of the bar contains life in any form—*Bacteria*, for instance.

A marked change took place in the hydrographic state on the coastal banks between February 8th and 21st, particularly in the southern districts (the Gothenburg island belt), a change which is the more interesting as with it the herring fishing came to an end. During these 13 days the warm and salt bottom water withdrew seawards, and the herrings went with it. The bank water outside the island belt entered within the belt under the Baltic water diluted by the Göta river, and in this water fishing was prosecuted during the preceding months. The gas analysis showed the same proportion of nitrogen, but a diminution of oxygen and a larger quantity of carbonic acid in the bank water within the belt, so that the presence of the fish had made itself felt in spite of the rapid changes in the water layers. In this winter's fishing season the herring ascended farther up the waterways and fiords, and it was found that the bank water stood higher along the coast and entered the deep channels in the fiords, where in the deepest hollows water of comparatively high temperature and salinity remained. A line of soundings along the deep hollows of the waterway from Marstrand to Swansund showed that at a depth of 30 mètres bank water at about 3·8° C. still remained in February from the inflow of the previous year.

The extraordinarily favourable weather in February permitted special attention to be paid to the deepest part of the Skagerack, at stations S_{vii} and S_{viii}. Of peculiar importance was the temperature at station S_{viii} at 612 mètres, which both by Pettersson's heat-insulating apparatus and by a Negretti and Zambra thermometer proved to be about 5·8° C. As the bottom layer had a salinity of 35·24°/$_{oo}$ and 13·41 cc. of nitrogen, it must have absorbed air at 4·6° C. The oxygen was somewhat small in quantity, 5·99 cc. or 30·9°/$_{o}$. These figures, compared with those obtained in February 1890, show that even in the greatest depths there is no stagnation such as occurs in the hollows of the Baltic Sea.

The Skagerack in December 1896.

As the herring fishery in the autumn of 1896 was almost a total failure, the Hydrographic Commission was requested by the Gothenburg Fishing Association to inquire into the circumstances. Accordingly, an investigation was instituted in conjunction with Dr. Hjort.

The hydrographic conditions were found to be very different from those usually prevailing at this season. The Baltic water covered the central and northern parts of the Skagerack even in the middle and end of December, except a small area at the north-east, where the north-easterly winds drove away the surface water and allowed the warmer waters to appear in the lee of the coast. The bank water had not, therefore, flowed into the Skagerack this year in its usual volume. It is further noticeable that 35°/$_{oo}$ water appeared this season off the north-west coast of Jutland, an exceptional occurrence, for water of such high salinity was never known before to enter the Skagerack on the surface, being already covered with lighter water before the mouth of the Skagerack. This water came from the large expanse of Gulf Stream

water which stretched across the North Sea plateau from the Orkneys to the Fisher Banks and the mouth of the Skagerack, and between the sixth and ninth meridians was covered by 34 and 33 water; in the Skagerack itself the bank water was of insufficient volume to cover the inflowing 35 water, which this winter rose to an unusual height.

Under ordinary circumstances all the isohalines slope down to the Swedish coast banks, so that the incoming waters stand highest in the middle of the Skagerack and lowest at the coasts, while the Baltic water, as a rule reduced in winter to a small stream, flows along the hollow by the coast formed in the underlying layer. This layer usually consists of bank water, which is heaped up against the coast, and there forms a thicker layer than in the middle of the sea. But the arrangement in December 1896 was quite exceptional, the Baltic stream being thinner on the Swedish coast than in the middle of the Skagerack, while the 35 water stood higher on this coast than in the middle; and as the salter layer below rose so high, the bank water also attained a higher level, but in *a very thin layer, only a fourth or fifth of its usual thickness*. The updrift or drawing in of salt oceanic water caused the 35 water, which rarely enters the Kattegat, to fill the deep channel up to 42 mètres from the surface.

The cause of this unusual updrift of 35 and 34 water was chiefly the easterly winds, which prevailed with extraordinary frequency throughout the winter, interrupted only by a few westerly storms. The updrift of the lower layers was a reaction effect of the influence of the winds on the surface water. The winds also hindered the usual movement of the waters by preventing the new surface water, the bank water, from approaching the Swedish coasts.[1] This year it did not reach farther than the line from the Skaw to Christiansand on the surface, meeting here the Baltic water and producing a wide belt of blended water along the Norwegian coast. Both these waters were deepest in the centre of the Skagerack, where they met. Only a thin sheet of bank water reached the Swedish coast, where it was not more than 7 mètres thick, and to this fact is due, no doubt, the failure of the herring fishery.

In August and September the southern bank water flowed in past the north-west coast of Jutland, and the fishery was productive between Vinga, Marstrand, and Nidingen. This fishery came to an end in October, and then the northern bank water began to flow in, and the winter herring appeared off the Bohuslän coast, but the water did not penetrate the fiords in the usual quantity, so that the renewal of the water did not take place, and with the east winds the herring disappeared.

The contrast between the surface layer and the underlying 34 water, which even in February had a temperature of 5° to 6° C., must have exercised a considerable influence on the temperature of the air and on the weather. The thin layer of Baltic water had a temperature of

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[1] Dr. Fulton's experiments on surface currents in the North Sea showed that the surf water in this and the following month was driven from the mouth of the Skagerack to the English coast. See vol. xiii. p. 643, and the chart on the opposite page.

2° to 3° in December, which fell to 0° or 1° at the beginning of January 1897, and contributed greatly to keep down the air temperature. Under ordinary circumstances, when bank water lies on the surface, the air over the Skagerack is in contact with water of about 5° C. in December and 3 to 4° in January, but at the beginning of January 1897 Baltic water covered the surface, and its temperature was only 0° to 1° C. The cooling down of this thin layer had begun in December, and was favourable to the development of a cold period which commenced at the beginning of the year. But this period was interrupted; the easterly winds drove the Baltic water from the coast, and an expanse of salter water at a temperature of 5·7° to 6·5° C., spread on the 17th and 18th along the northern island belt from Strömstad to Hallö, and to a distance of several miles from the coast. The air temperature was very low (−10° C.), and the higher temperature of the water gave rise to fogs and upward air currents. A few days later the air temperature rose to 5° to 6° C., but storms from the west drove the surface water back to the coast, and cold weather again prevailed. Another break occurred at the end of the month, which again was brought to an end between February 1st and 8th by westerly winds. Thus the weather-changes are evidently in close connection with the hydrographical, and it should be noticed that the changes in the surface of the sea preceded the change of weather from cold to mild. The meteorological conditions in the Skagerack in winter should be studied in connection with the surface-changes, and especially the effect of a layer of Baltic water over a great part of the sea.[1] At the end of 1896 the anticyclone, which lay over the Scandinavian peninsula, and caused the north-easterly winds in the Skagerack, continued till December 24th, when stormy weather set in. The centre of depression lay over the North Sea, and in the following days the Skagerack was included in the low-pressure area. Also a local cyclonic area seems to have been formed in the Skagerack. During the preceding cold period the air pressure had been higher and the temperature lower over the north-eastern Skagerack than at Christiansand or by Hanstholmen, but on December 24 the wind at Strömstad veered round to the south-west, though everywhere else around the Skagerack it still blew from the east. This was evidently caused by the preceding updrift of warm salt water off the coast, which began on December 17th to 18th. As to the second break in the weather, on February 1st, the winds on the coasts of the Skagerack had been north or north-east from January 26th. The conditions in the open sea are not easily ascertained. In the North Sea area there seems to have been several small depressions, not clearly separated from one another, of which one was probably over the Skagerack. The meteorological charts are insufficient for the study of the weather in relation to hydrographic phenomena, and observations on steamboats are very desirable, at any rate in winter.

A surface chart of the North Sea shows a very different state in the autumn of 1896 from that in preceding years—1893, for instance. In the

[1] The conditions in ordinary winters are set forth in vol. x. p. 359.

latter winter the northern bank water current was confined to the Norwegian deep channel and the Skagerack, and there was no connection with the southern bank water after November. But at the end of 1896 and the beginning of 1897 the situation was very different. The two marginal formations of 32 and 33 water flowed together opposite the mouth of the Skagerack. Thus the water which usually carries the herrings with it to the Skagerack was more spread out than in normal years, and only a thin sheet extended into the Skagerack.

Changes in the Baltic Sea since the Swedish Expedition of 1877.

Prof. Ekman's investigations in 1877 illustrated the condition of the Baltic at that time in all its details, and as the hydrography of the sea is so uniform, its general characteristics at any particular time may be portrayed simply on the basis of observations at a few individual stations, those, namely, in the five deep hollows, Nos. 67, 96, 94, 70, and 35.[1] As the Swedish Commission was unable to carry out all the necessary soundings themselves, they thankfully accepted the assistance of Professor Krümmel, who undertook to make observations in the western and southern parts of the sea as nearly as possible simultaneously with the Swedish. The days chosen were May 1st, Aug. 1st, Nov. 1st, and Feb. 1st, which were also those appointed for joint investigations of the Swedish, Norwegian, English, and Danish hydrographers, the object being to connect the hydrography of the Baltic with that of the ocean and the intervening narrow seas. Ekman's observations had furnished a purview of the circulation between the North and Baltic seas, which indicated that a constant surface-stream flowed out from the Baltic, while an intermittent under-current passed through the Kattegat and Great Belt into the western Baltic, where it moved so slowly that the water in the deep hollows was apparently stagnant, and investigations in the deep hollow east of Landsort in 1891 had confirmed this view, whereas the water layers in the Skagerack are subject to thorough changes with the seasons. It was, then, purposed to obtain, by means of combined observations, answers to the following questions:—

1. Whether the under-current into the Baltic, over the threshold between Gjedser and Darsserort, is really intermittent, and how it behaves at different seasons?

2. What influence the periodic changes in the waters of the Skagerack exercise on the bottom layers of the Kattegat and Baltic Sea, and on the salinity, temperature, and gaseous contents?

3. How does the displacement of water proceed in the various basins of the Baltic, and when does the displacement occur in the different sections separated by submarine ridges?

4. To what level is the temperature of the water determined, by convection currents from above, or by the temperature of the under-current?

5. How is the ventilation accomplished at these levels?

The above questions concern the conditions of the under-current and

[1] See vol. x. p. 617 *et seqq.* and chart facing p. 620.

lower levels. As regards the surface water the following points were to be inquired into:—

6. The production of the blended water accompanying the Baltic stream. As before remarked, the outflowing water has a salinity of 8 to 10‰, but on reaching the mouth of the Kattegat has attained to 30‰, and therefore the Kattegat must present favourable conditions for blending.

7. The distribution of animal and vegetable plankton in the Baltic and the Baltic current in different tracts at all seasons.

The results have been fully discussed in two articles by Professors Pettersson and Krümmel,[1] and therefore it will suffice here to state briefly how far the above questions have been answered. The plan, which has been described, could not be carried out in its entirety, as it was not always possible to execute simultaneous soundings, and the Baltic data cannot be satisfactorily connected with those in the North Sea, as the Danish determinations of salinity are not comparable with the Swedish and Norwegian, so that the under-current, the most important factor in the circulation, cannot be traced with absolute certainty. Some general results can, however, be given.

1. The conditions in the Öresund are fully revealed by the Danish investigations in the years 1891-1894, whence it appears that the depth in the most southern part is so small (about 7 mètres) that no regular change of water by means of the upper and lower streams can take place. But it may be expected that occasionally salt water from the Kattegat may be forced over the threshold when the level is high, much as the Baltic water now penetrates, in certain cases, through the Norrström into the Mälar lake. The Danish longitudinal sections show that Kattegat water of very high salinity (25 to 30‰) lies at all times against the northern side of the threshold and sometimes rises to its level, or even higher, as in May 1893. But friction against the bottom and the long slope of the southern side seems to prevent it from entering the Baltic, instead of which it is carried away by, and mixed with, the Baltic current. Its entrance by this passage must then be quite exceptional even if it occurs at all. The depth of the passage has been slowly diminishing ever since the *Littorina* period, and according to Dr. Siegers, the rise of the bottom is at the present time about 0·7 mètre a century.[2]

At the other threshold, between Gjedser and Darsserort, the movement is intermittent. Of four sections, two (17th to 22nd August 1871, and early in August 1894) show that the under-current was in action, while the other two (Ekman's of 1877 and Krümmel's of 1894) indicate that the course of the salter layer was checked. The Danish temperature charts and sections demonstrate the very important fact that the under-current through the Kattegat and western Baltic is most active, and carries the saltest water over the Baltic threshold, in summer, the season when the surface-current is strongest.

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[1] O. Krümmel: "Zur Physik der Ostsee." *Petermanns Mitt.*, 1895. O. Pettersson: *Bih. t. K. S. V. A. Handl.*, Bd. xix. Afd. ii. No. 4.

[2] *Seenschwankungen und Strandverschiebungen in Skandinavien.*

2. The salt water carried by the under-current over the thresholds and collected in the deep basins of the Baltic is comparatively cold. Accordingly, in these basins is found water of somewhat low temperature, still lower absorption temperature, and remarkably high proportion of nitrogen. This is winter water from the North Sea, and probably brings with it the strange forms of plankton already referred to.

3. At station 67 soundings were taken in November 1893, and in March 1896. The analyses of the samples prove that the deep water east of Bornholm is not stagnant, but was renewed in the interval. Below 50 mètres the under-current predominates, while above it lies the deep homogeneous surface layer, with a uniform salinity of 7·55 ‰, and a constant temperature in the cold season, in consequence of a vertical circulation by means of currents of cooled particles extending downwards to the isohaline of 8 ‰ at 50 mètres. This layer is also, owing to the vertical circulation, well ventilated. The nitrogen it contained was 18·13 cc. in March, against 15·23 cc. in November, the water having a greater power of absorption at 1·85° C. than at 8·55°.

How far, however, the water in the largest basin of the Baltic, east of Gothland, was renewed in the interval between Prof. Ekman's soundings of 1877 and the Swedish investigations of 1893, or Dr. Krümmel's in 1894, cannot be decided. The water below 80 to 100 mètres had the same salinity, 10 to 12 ‰, and nearly the same temperature. The only criterion that can solve the question—namely, the volume of gas—is not available, for it has only been determined from one sounding. It may be said, however, that, if any displacement of water took place during the twenty-two years, it must have proceeded very slowly and imperceptibly.

The deepest hollow of the Baltic lies a few miles south-east of Landsort. In this basin the bottom water below 80 to 100 mètres has certainly been stagnant since 1877. As Professor Pettersson considered the station of great importance it was sounded from time to time. In 1891 Professor Pettersson took soundings, assisted by Dr. Ekman, and in 1893 the work was performed by Herr Jensen. The conditions were found to have suffered no change since 1877, except that the quantity of oxygen was much diminished in the bottom layer between September 1891 and July 1893. The salinity, temperature, and volume of nitrogen were identical in all three cases at 400 mètres, but the oxygen diminished from 3·2 cc. per litre, or 16·15 %, in 1891, to 1·33 cc., or 7·31 %, in 1893. A significant contrast is presented by the nitrogen, which in 1891 was 16·67 cc., and 16·82 cc. in 1893, or within the limits of errors of analysis.

A very remarkable difference has been brought to light between the bottom water in the Baltic proper and in the northern gulf, for instance in the Aland sea, which is cut off from the Baltic by a ridge between the Stockholm island-belt and the Finland island-belt at Hangö. On both sides of the ridge, which cannot be more than 60 mètres at most below the surface, are large depressions, and as the deep water in the farthest deep basin of the Baltic is stagnant, it might naturally be expected that the same conditions would obtain in the Aland sea. But the conditions

are reversed. The gaseous contents at a depth of 200 mètres are as follows :—

Station 96, Gothland Basin,	.	16·59 cc. N_2; 1·21 cc. O_2 = 6·83%.
„ 94, Landsort Deep,	.	17·08 cc. N_2; 2·73 cc. O_2 = 13·80%.
„ 70, Åland Sea,	.	18·07 cc. N_2; 8·17 cc. O_2 = 31·98%.

This extraordinary difference is explained by the salinity, which at the three stations was 11·84 ‰, 10·22 ‰, and 7·21 ‰ respectively. The under-current in the Baltic proper has its origin *outside* the limits of the sea, as the former water specimens prove, and at some previous period lay on the surface of the Kattegat, or one of the Danish sounds, and there absorbed its air. Afterwards the under-current wholly or partially failed, and the large deep basins of the Baltic are now only partly filled with a stagnant remnant of the salter waters of the current when it flowed more freely, which has in the course of years been exposed to loss of oxygen in an unusual degree.

The bottom water in the Åland sea, on the other hand, originates *from the Baltic itself*, as may be seen by tracing the cuneiform layer of 7 to 8 ‰ salinity, which is the deep water in the Åland sea, but the surface stratum in the Baltic proper. The lowest stratum of this water passes over the ridge into the Åland sea, and there forms a well-ventilated mass, for the whole stratum of 7 to 8 ‰ in the Baltic is thoroughly ventilated by convection currents. The Åland under-current is, then, in full flow, and consists of water from the surface of the Baltic, which is cooled down and sinks in winter. Accordingly it has the same temperature, 1·7° to 1·8° C., as the upper water on the Baltic in winter. In the Bothnia sea, also, the deep water is better ventilated than in the Baltic proper.

Questions 5 and 6 can be answered from the foregoing exposition. The level to which the temperature is determined by atmospheric influence through convection is marked in the Baltic proper by the isohaline of 8 ‰, in the Åland sea by that of 7 ‰, and in the sea of Bothnia by the isohaline of 6 ‰. Below these limits the temperature is ruled by the under-current, which in the Baltic is intermittent, causing a very slow circulation and partial stagnation, but in the Gulf of Bothnia consists of winter water from the surface of the Baltic.

6. The Commission addressed to the chief of the Nautical Meteorological Bureau, Commander Malmberg, a request that the superintendents of five lightships on the Baltic and Kattegat might be allowed to collect plankton several times each month of 1895 and 1896, and the abundant material thus obtained was examined by Professor P. T. Cleve and Dr. C. Aurivillius, who have made known the results in special publications.

7. The process of blending which goes on in the Kattegat can best be studied in the charts and sections of the Danish reports. The agent is the friction between the surface and under currents, particularly at the edges and extremities of the deep channels, where the lower water is forced up to the plateaus on which, owing to the shallowness, the wave motion mixes the waters into a homogeneous stratum. On these large plateaus, especially on the western side, such as the Aarhus and Aalborg plateaus, there are at almost all seasons large quantities of homogeneous

water of 15 to 25°/₀₀ salinity, which Dr. Rördam calls "Kattegat water." But it is not homogeneous in the same sense as the Baltic surface water, which extends from the Finland to the Öresund, with a uniform salinity of 7 and 8°/₀₀, or as the Skagerack bank water in winter, or the North Sea plateau's broad area of 35°/₀₀ water. The Kattegat is a transitional area where the blended water is produced, which, on entering the Skagerack, is known as the Baltic stream, and undergoes no further change of importance.

The above is a mere outline of the results of recent hydrographic research, which can only be thoroughly studied with the help of the tables, charts, and sections in the work of Professors Pettersson and Ekman, and those of the British, German, and Danish hydrographers.

Our thanks are due to Professor Pettersson for kindly revising this paper.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

Traffic on the Transcaspian Railway.—In 1897 there was a large increase of traffic, principally due to the transport of goods, for the number of passengers was only 285,000, against 282,000 in 1896, an increase of little more than one per cent. On the other hand, the weight of goods carried rose from 283,000 tons in 1896 to 377,000 tons in 1897, an increase of 33 per cent. The gross receipts rose 33 per cent., and the net profit, £273,000, was nearly 80 per cent. greater. There was a large addition of material of construction, for the railways Samarkand-Andijan and Merv-Kushk were being made. But the general progress of commercial undertakings also contributed to raise the goods traffic, the articles of commerce weighing 267,000 tons, or 16 per cent. more than in 1896. The chief export, as heretofore, was cotton, chiefly from Ferghana, amounting to nearly 97,000 tons and sufficient to supply one-third of the demand of the Russian cotton manufacture.—*Petermanns Mitt.*, Bd. xliv. No. 7.

The Hydrography of the Caucasus.—In the *Mémoires* of the Geneva Geog. Soc., 5e Série, Tome ix., M. V. Dingelstedt treats of the rivers of the Caucasus and their geological action. The annual rainfall, as far as the scanty records indicate, amounts to about 27½ inches, and as the evaporation is very great, probably only a fourth of this finds its way ultimately into the rivers. Consequently this country, some 177,000 square miles in area, is irrigated by only a fraction of the water per unit of area that the lands in the Rhone valley receive. Moreover, the distribution is very unequal in the various river-basins.

The Black Sea district in the south-west is the best irrigated, and its waters are spread out over a number of distinct basins. The northern zone comes next in quantity of water and number of basins; while the Caspian zone at the south-east is the driest, and almost all its waters are collected into one basin. The last constitutes about 43 per cent. of the total area of the country, and its mean annual rainfall varies from 10 to 18 inches. The northern zone occupies nearly half the total area, and its rainfall is about 24 inches. It is subject to the influence of the vast expanse of land to the north. Besides a few streams that lose themselves in

the steppes, it contains only two basins, those of the Terek and Kuban, which rise near together on the flanks of Mount Elbrus and flow in opposite directions. The favoured zone of the Black Sea occupies only an eighth part of the total area, but it receives a rainfall of about the average amount that falls in the mountainous districts of Europe—over 50 inches—and contains the basins of the Rion, Chorokh, Ingur, and Kodor, besides some hundred smaller streams, all of which flow separately into the Black Sea.

The mountain chains which traverse the Caucasus divide it longitudinally and transversely into four parts. On the north-east is the northern basin of the Caspian with an area of 47,344 square miles, to which belong the Terek, Kuma, Manych, and Kalaus; on the north-west, the basin of the Sea of Azov (35,493 square miles), with the Kuban, Eia, and Kagalnik; on the south-east the southern Caspian basin (74,478 square miles), with the Kura and Araxes, the Sulak, Samur, and Lenkoran; and lastly, on the south-west, the Black Sea basin (15,214 square miles), with the Rion, Chorokh, Ingur, Kodor and many others.

The main watersheds run together for a distance of eighty miles in the central part of the great chain of the Caucasus. The longitudinal line is sinuous, measuring from the hills of Taman to Ikhi-dagh, on the shore of the Caspian, 940 miles, whereas the distance in a straight line between its extremites is only 660. It gradually rises in altitude from the north-west to the southern ramifications of Elbrus, south of which the two great lines of waterparting cross one another and run together for some distance. The other main watershed, separating the Caspian from the Sea of Azov basins, begins in the north by a small elevation at Stavropol, and, running along the crests of Kumbashi and Yashla-syrt, west of Piatigorsk, joins the longitudinal watershed on the flanks of Elbrus. Its southern continuation leaves the main range at Mount Sikari, runs at first south-west and then due south to its junction with the mountains of Akhaltzykh and Imeretia, thus forming a link between the Great and Little Caucasus. In spite of its small elevation, this ridge exercises a great influence on the climate, arresting a considerable portion of the moisture of the winds blowing from the Black Sea.

All the principal streams of the Caucasus have a torrential section, where their fall attains 2 per 100. These slopes gradually diminish as the rivers enter the plains, and near their mouths become insignificant. The Rion, which has a velocity of 13·3 feet per second, flows less than one foot per second at its mouth, and the Kuban only $2\frac{1}{4}$ to 3 feet. It is curious that the four chief rivers, the Kura, Kuban, Terek, and Rion, though their basins are of very unequal area, have about the same discharge—the former two about 13,400 cubic feet per second, and the latter two rather less, say, 12,700. This is about the volume carried down by the Tessin, but the ratio in Swiss rivers between low water and flood, 1 to 54, is never attained by Caucasian rivers, for the floods of the Kura, for example, never exceed 53,000 cubic feet per second. There is a certain analogy between the four great rivers of the Caucasus and those of the Alps. The Kura and Kuban flow, like the Rhine and Rhone, in longitudinal tectonic valleys, while the Terek and Rion, like the Aar and Tessin, follow transverse valleys.

The streams in descending from the heights have exerted a powerful geological action, cutting cañons several thousand feet in depth on their upper courses, and depositing the detritus in the plains and deltas. In their upper courses they drive along stones, large pebbles, gravel and sand, and deposit during floods a large quantity on their way, but keep the mud for their mouths. Supposing that the Cretaceous and Jurassic strata now interrupted by the main chain were once continuous, it may be estimated that the layer removed by the rivers had a depth of 13,000 to 16,000 feet. The manner in which the alluvium is laid down in the

valleys varies according to the form of the land, the climate, and the amount of the rainfall. Sometimes it accumulates, as in parts of the valleys of the Kura and Araxes, along the banks, raising their height; sometimes it is deposited in the bed of the river and raises the level of the channel, as in the lower Terek, while sometimes it tends rather to one bank than the other, forcing the stream to alter its course.

The mud that reaches the Caspian and Azov is gradually spread over the sea bottom, extending the shores in the form of deltas and prominences, while the solid matter that enters the Black Sea, though equally fine, is able only, owing to winds and strong currents, to form bars which impede navigation. The volume of solid matter brought down annually by the Kura to its mouth has been estimated at fully 35 million cubic yards. It enters the sea by two mouths, the Kura proper and the Akusha, which enclose an island of alluvium 270 square miles in area. This island increases by 50 to 60 square yards annually. The Kuban carries to the Sea of Azov, through its many mouths, some 31½ million cubic yards of alluvium yearly. Its delta is fully 3090 square miles in area, and the volume of the alluvium of which it is composed has been estimated by M. Danilevski at 1618 cubic miles, which at the present rate of growth must have taken 280,000 years to accumulate. The alluvium of the Terek amounts to 102 million cubic yards. As the bed of the river is partly enclosed by dykes, this deposit is raising the bed near Kizlar at the rate of 2½ inches a year. Below Kizlar it has formed an alluvial plain 390 square miles in extent, covered with marshes and small lakes, and the inhabitants maintain a continual struggle against its encroachments. The fourth great river, the Rion, does not form a delta, and the 12 or 13 million cubic yards of alluvium it discharges yearly make no marked impression on the shores of the Black Sea. At the confluence of its principal tributary, the Tskhenis-Tskhali, it has formed an alluvial plain 1300 square miles or more in area. Thus, fully 180 million cubic yards are annually carried down from the mountains to the sea. The figures cited above are very rough estimates, and give only an approximate idea of the eroding work of the rivers.

Extraordinary Rainfall in Ceylon.—The *Quarterly Journal of the Royal Meteorological Society*, July, contains particulars relating to the remarkable rainfall at Nedunkeni. The village is situated eleven miles down the southern road to Mullaittion, at an elevation of 122 feet above sea-level. A rain-gauge has been established in the grounds of the dispensary for about three years, and the records are regularly transmitted to the Public Works Office. Though the mean annual rainfall is probably little more than 50 inches, the fall for December 1897 was 67·07 inches, of which 31·72 were measured at 9.30 A.M. on Dec. 16th as the fall of the preceding twenty-four hours. Very few falls of more than 15 inches in the day have been previously recorded in Ceylon. On Dec. 14-15, 1896, 18·75 inches were measured at St. Martin's estate, Rangalla, Central Province, 3600 feet above sea-level, where the annual mean is 173·56 inches; and six other instances are recorded in the returns of the Public Works Department, the largest being 19·5 inches at Devilane, but the accuracy of these latter records has not been tested. As regards the Nedunkeni fall, Mr. H. Parker, irrigation assistant, states that the amount mentioned above was, in his opinion, accurately measured, and concludes that the rainfall, owing to various causes of error, was probably still greater. From 9.30 A.M. to 6.30 P.M. on Dec. 15th the intensity of the rain was almost exactly 1½ inches per hour.

Hainan.—An article by M. Cl. Madrolle on this island, now annexed by France, which he visited in 1896, is published in the *Bull. de la Soc. de Géographie*, 2e

Trim. A preliminary notice appeared last year in the *Bull. de la Soc. de Géographie Comm. de Paris* (see vol. xiii. p. 490), but it contained little information on the geography of the island. Hainan means "south of the sea," and signifies a land on the south separated from the mainland. The channel between it and the peninsula of Lei-chau is about seventeen miles broad. The area of the island has been calculated as 13,975 square miles, and is about that of Brittany. Its form is oval, with a main axis, running from south-east to south-west, about 192 miles in length, and a transverse axis of 137 miles. The mountain group of Sai is the central feature of the configuration, and round this are arranged the plateaus and plains which compose it. The highest range bears the name of the great mountain of the Five Fingers, from the five summits which surmount it; it is also called by the Chinese simply Ta-chan, or Great Mountain, and also the Mother of the Li, the name they give to the independent mountaineers who inhabit it. Towards the north the surface is much diversified as far as Nam-fong, and then the plateau descends towards the strait; on the south the country retains a high level as far as Ngai-tsiu and Vang-tsiu. The Sai group is composed of granite and schist. At present the exact age of the rocks has not been ascertained, but probably they are Silurian. In some places outcrops of sandstone, quartz, and limestones may be seen. Around the mountains a sandy clay formation completes the structure of Hainan, and beyond long stretches of sand and dunes extend to the sea. Eruptive rocks occur more or less in all parts, and earthquakes have often caused great destruction. Minerals are abundant—argentiferous lead, copper and tin—and flakes of gold are found in the torrents descending from the great chain of the Five Fingers.

Hainan may be divided into three slopes, that of the strait of Hainan, with the basins of the Fu-ho and Lim-ko-ho, that of the Gulf of Tonkin, with the rivers Dam-tiao, Sang-hoi, and Kam-un, and lastly, that of the China Sea, which includes a number of coastal basins. With the exception of a few streams on the north-east, all the rivers rise in the central elevated mass. The most important is the Fu-ho, which enters the strait of Hainan at Hae-kao by a labyrinth of arms after a course of 134 miles or thereabouts. It can float light canoes at Fong-si, but its navigable section proper does not begin till Deing-an, and the Chinese have been obliged to retain the water by a score of dams. The strait on the north, 9 miles wide at its western entrance and 12 miles at the other end, is obstructed by sand-banks extending north-westwards for a length of nearly 25 miles. The paucity of lights and the fog which prevails through half the year render the passage dangerous. The south and south-east coasts offer some excellent shelters against the north-east monsoon, such as Gaalong and Yu-lin-kiang. The south-west and west are lined with banks which stretch out to sea for some 20 miles, but in the north-west there are some good roadsteads, among them Hiong-po and Hao-Siu.

The flora, corresponding to the position of the island, is tropical. The sands of the coast lend a dreary aspect at first sight, but near watercourses grows a vegetation that the Chinese know how to improve, and in the better soil of the inland valleys it becomes luxuriant and picturesque. An infinite variety of palms, oak, teak, banian, sandalwood, ebony, and box are a few of the indigenous trees. There are twenty-three kinds of rice, twenty-four species of potatoes; and wheat, taro, and maize are also cultivated. Sesamum, castor oil, and tobacco are seen in the valley of the Fu-ho, and the ground-nut on sandy soil. Bananas, cocoanuts, lemons, oranges, pomegranates, papaws, mangoes, apples, and olives are the principal fruits, and nearly all the Chinese vegetables grow in Hainan. Sugar-cane is an important article of export.

The tiger and rhinoceros have almost disappeared, and the wild boar is, perhaps,

the only dangerous animal in the mountain region. Monkeys, large and small, are numerous in the forests of the interior. Deer and antelope are hunted by the Sai, and small hares are plentiful in the district of Ka-chek. Turtles of divers species, crabs, mussels, and oysters are found in the waters; large and dangerous snakes, scorpions, tarantulas, and leeches are the chief pests of the land. Fowls and ducks are kept by the natives. The wild birds are remarkable for their beautiful plumage, and are of many different species. The principal animal is the pig. Every Chinese family tends its pigs carefully, and these animals, estimated at 2,000,000 in number, are the chief article of export. The zebu is the chief draught animal, and there are 55,000 in the island; but 35,000 buffaloes are employed in the rice fields of the districts of King-toa, Dio-rai, and Hiu-tong. Sheep are rare, goats more numerous, and a few horses have been imported from the mainland.

The climate is naturally warm, but the heat is much modified by the monsoon winds, and the frequent fogs and heavy dew freshen the atmosphere. The north-east monsoon blows in winter, and brings rain and cool weather, while the south-east produces a heavy atmosphere with storms and squalls almost daily. December and January are the pleasantest months, as the thermometer is then lowest, marking on the average 50° F. at 6 A.M. and 57° at 2 P.M. May is very warm, and in June the heat is almost unbearable. At Haé-kao the thermometer marks 95° in the shade between noon and three o'clock, and does not fall below 82° during the night. Typhoons occur from June to October; they are most violent in August and September, and the frequent squalls which sweep the north and east coasts work great havoc among the Chinese coasting vessels.

Nothing is known of the history of Hainan before the northern Chinese occupied the southern provinces of the present empire. In remote times the island seems to have been inhabited by the Sai, who are now to be found in the centre, and must be considered the true autochthones. In later times, the Min or Miao-tse crossed the strait, establishing themselves in the north. In 108 B.C. the Chinese crossed over to Hainan, and having defeated the aborigines, took possession of the island. The struggles between the invaders and the Sai and the Min, which have continued up to the present time, mainly constitute the history of Hainan. It has also been exposed at various times to the incursions of Tonkinese, Annamites, Malays, and Japanese. It is now divided for administrative purposes into thirteen districts, which are again subdivided into cantons. Among the most important towns are King-tea, the capital, with a population of 25,000, and Haé-kao, a port open to foreign commerce.

The four principal races are the Hoklo, the Hakka, the Min, and Sai. A number of individuals have also come here from almost all parts of the Chinese empire. Probably 1,705,000 Chinamen now dwell in the island; to these must be added about 100,000 Sai and 5000 Min, both of which races are quite independent. The Min inhabit part of the mountain region, where the land is often poor, but they are industrious, and contrive to win from the soil the necessaries of their frugal life. Like the Sai, they live in groups; they are timid and honest and harm no one. The Sai, living more to the south, have defended their territory for more than 2000 years against successive invasions of the Chinese, have preserved their freedom, and retained their own manners and customs. Their skin is dark, and the women tattoo themselves in blue patterns. They live in a simple mud cabin or in a cave. But most commonly the dwelling is built against a rock or the side of a hill, and supported by two or three rows of piles. The floor is made of beams and branches covered with stamped earth, and the interior is divided by mats into rooms. The whole is roofed with thatch or

leaves. Red rice, maize, the produce of their cattle and the chase constitute their food. Their language, of which there are several dialects, has an evident resemblance to dialects of the west of Kwang-si, South Yunnan, and the Black river of Tonkin.

AMERICA.

The Rio Inambary.—This river, which marks the boundary between Peru and Bolivia, has frequently been referred to in these notes. It may be remembered that Colonel Pando fixed, in 1893 (vol. xii. p. 100), the co-ordinates of its mouth as 12° 42′ S. lat. and 62° 43′ W. long. Then a doubt arose whether the river visited by Colonel Pando was the Inambary, which, according to the map of Raimondi, rises in the heights of the Sina, in the province of Sandia, runs westward, receiving the Sangaban and the Marcapata, and flows into the Madre de Dios, or rather forms that river, at 71° 10′ W. long. To decide the question, Colonel Pando was sent out again last year, as reported on page 380, and found that the Rio Lanza, there mentioned, is the stream called the Rio de la Villa before the bark industry sprang up, and denominated Tambopata by Raimondi, and Rio Pando by Suarez, Fiscarrald, and others. Joined by the Tambopata, or Saqui, the Asata, Colorado, Crevaux, etc., it enters the Madre de Dios at lat. 12° 42′ S. and long. 69° 43′ W., and is therefore the river formerly mistaken by Colonel Pando for the Inambary.

Ascending the Asata for three days' march, the traveller comes to the water-shed, and, descending a stream, probably the Pilcomayo, can reach in two days more the Inambary, or rather the Huari-huari. This river, therefore, must join the Madre de Dios farther westwards than the Pando, and its mouth should be determined astronomically.

So great was the ignorance of the Lanza in 1893, that Raimondi believed it to be the Madidi, which river rises, not in the snowy cordillera, but in the province of Caupolican, on the meridian of Apolo, and runs a considerable distance west and north-west before turning north-east to join the Beni. The relations of the river Heath, known also as the Abuyama, according to Colonel Muñoz, have also been cleared up by Colonel Pando. The engineer Felix Müller, having traced the river to the neighbourhood of Putinapuncu, the place on the Tambopata reached by Raimondi, concluded that it was identical with that river; but Colonel Pando now affirms that the Heath is a tributary of the Madre de Dios. Müller was misled by the position of Putinapuncu on Raimondi's map, where it is placed about twenty minutes too far north. The Heath or Abuyama enters the Madre de Dios at lat. 12° 34′ S. and long. 69° 7′ W. Like the Madidi, it rises in the most advanced spurs of the mountains that dominate the vast plain of Caupolican.—*Expedicion del Coronel Don J. M. Pando al Inambary* (Soc. Géogr. de la Paz).

The Meteorological Station on El Misti.—Of the first high-level station erected in Peru some account was given in vol. x. p. 209. The present highest station is situated at a height of 19,200 feet, and is one of eight stations established in Peru in connection with the Harvard University. The others are Mejia, 55 feet; La Joya, 4141; Arequipa, 8050; Pampa de los Huesos, 13,400; Misti (base), 15,700; Cuzco, 11,378; and Echarati, 3300. These places lie, roughly, in a line from south to north, extending from the sea-coast across both ranges of the cordillera to Echarati, at the head of the Amazon river system.

Arequipa stands about eighty miles from the Pacific coast, in the middle of the long desert belt which stretches along the west coast of South America from lat. 4° to 30° S. The station on El Misti was established in October 1893 by Professor

Solon I. Bailey, and is now furnished with dry and wet bulb and maximum and minimum thermometers, rain-gauge, Richard barograph, thermograph, and hydrograph, as also a meteorograph, specially constructed for this station, to record temperature, pressure, humidity, and wind direction and velocity, and capable of running for three months without rewinding. The observatory is now visited regularly about once a month.

In October and November Mr. R. de C. Ward paid visits to this lofty station. The journey from the observatory at Arequipa takes two days. Starting on mule-back at six or seven o'clock in the morning, the observers make a short stop about 3 or 4 P.M. at the instrument shelter on the Pampa de los Huesos, to wind up clocks and check the readings. The night is spent at the foot of the mountain, at an altitude of 15,700 feet above sea-level. Here is the Mont Blanc station, so called because it is almost exactly at the same height as the summit of the Alpine mountain. From the hut to the summit the ascent occupies four or five hours, and the descent is made in an hour and a half. Fortunately no physical exertion is required to reach the summit, or the observers would suffer severely from mountain sickness. The mules seem to bear the rarified atmosphere remarkably well, though they suffer from shortness of breath. Mr. Ward, on his ascent in October, began to feel the effects of the elevation at 13,400 feet, and at the Mont Blanc hut experienced great discomfort. At the summit he was entirely prostrate and unable to lift a barograph, weighing about ten pounds, into the shelter. His temperature twelve hours before leaving Arequipa was 98·4°, his respiration 24, and pulse 90 ; on the summit the temperature was 96·4, respiration 34, and pulse 110. On his second trip, Mr. Ward was able to walk 300 feet to the instrument shelter from the hut at the Mont Blanc station, making two stops on the way. An hour after this exercise his pulse was 128, temperature 97°, and respiration 30 ; while at Arequipa, twelve hours before, the corresponding figures were 91, 98·6°, and 20. Twenty minutes after reaching the summit the temperature was 97·2°, pulse 120, and respiration 32. Mr. Ward fared full as well as most who have made the ascent. One or two have felt no discomfort, and the native guides of mixed Spanish and Indian blood feel as well on the summit as they do at the base.—*Monthly Weather Review*, April.

Mr. Ward has published his sphygmographic curves in the *Journal of the Boston Soc. of Medical Sciences.*

Exploration in Chile.—We have received from Dr. Steffen the following brief account of his work during the past season :—

"The members of the expedition organised by a decree of the Chilian Government in November 1897 were, besides myself as leader, Carlos Sands (for astronomical observations) and Robert Krautmacher (as naturalist). The principal object was to examine the relief and hydrography of the section of the cordillera in 44° 30′ S. lat., which was practically unknown. In particular, the neighbourhood of the watershed between the Estuario de Poyehuapi, one of the many typical fiords of the west Patagonian coast, and the lake basins of the Lagos de la Plata and Fontana were to be investigated, and some knowledge obtained of the 'Lagunas Elizalde' that appear on Argentine maps, and of the 'Rio Felix Frias.'

"Leaving Puerto Montt on December 28th, on the steamer *Chacao*, we explored the coasts of Poyehuapi fiord, which are very defectively represented on charts, and landed on January 2nd at the mouth of a large river (in 44° 45′ S. lat. about), which was only once seen before, by the Chilian Captain Simpson in 1873, who named it Rio Cisnes. Through the valley of this river, which rivals the Aisen, and descends from the cordillera, first from the south-east, then from the east and

east-north-east, we made our way into the interior, but unfortunately were detained during January and the greater part of February by unusually bad weather. As early as January 13th we had to leave our boat at the foot of an impassable rapid, and march through the forest on the banks and over the range that hems in the valley. The forest is very similar to that on the lower Aisen (see vol. xiii. p. 494); the geological formation is granite. Large clumps of the valuable Mañiu yew (*Podocarpus* and *Saxegothea*) stud the river alluvium. On February 24th a lofty snow-capped mountain on the north side of the valley, 4600 feet high, was climbed, and it was ascertained that the whole visible section of the cordillera, in which, according to the latest map of Dr. F. P. Moreno, the north-western half of the La Plata lake should be situated, is tributary to the Rio Cisnes, the upper valley of which penetrates deeply into the snowy heights of the cordillera, and doubtless forms the chief drainage channel of the whole Andine region between the Palena and Aisen. The extremity of the La Plata lake must then be displaced much farther towards the south-east, for the whole section of the cordillera from the Poyehuapi fiord as far as the 72nd meridian at least is drained by the Rio Cisnes to the Pacific Ocean.

"The settled bad weather, and the difficulties of transporting our baggage and a boat in sections, rendered it impossible to make a long search for a pass over to the La Plata lake, which on the northern side is begirt by a lofty chain covered with ice and snow. Therefore, on March 12th, most of the men were sent back to the coast, while we, with only five men, resolved to advance up the more easily accessible valley of the Rio Cisnes in order to solve the problem of the origin of the river.

"We soon reached a tract where an enormous fire, ten years before, had destroyed the forest in the valley and on the adjacent heights. But exuberant vegetation, especially *chusquea* (reeds), had sprung up, which rendered our progress extremely difficult. In addition, snow began to fall on March 26th, and pursued us right into the pampa. The provisions began to fail, but we could always obtain fresh meat by shooting *huemul* (*Cervus chilensis*). Mighty accumulations of detritus, in terraces rising one above another like railway embankments, line both sides of the valley, and indicate former levels of the river bed, perhaps also the former level of the sea. Sometimes the valley is contracted by steep rocky walls, sometimes it expands into roomy basins of great value to future colonisation.

"A comparison of our itinerary with the latest maps showed that we had reached the basin of the Rio Felix Frias or Rio Frias, already roughly explored from the Argentine side. On its hydrographical relations many very different opinions have been expressed. While, according to the map of Ezcurra (*Plano del Territorio del Neuquen*, 1895), the Rio Frias is supposed to enter the Lagunas de Elizalde and thus drain into the Aisen, Dr. Moreno, the Argentine expert in the boundary question, adopts the old view that the Rio Frias is an affluent of the southern arm of the Palena (*Reconocimiento de la Region Andina de la Republica Argentina. Revista del Museo de la Plata*, Tomo viii. p. 290). It is now, however, proved that, firstly, the Lagunas Elizalde, which, according to Ezcurra, occupy a longitudinal valley of the cordillera nearly thirty miles in length, do not exist at all; and, secondly, that the Rio Frias constitutes a large independent river system, lying midway between the Palena and Aisen, and is identical with the Rio Cisnes.

"It was now imperative to make as rapidly as possible for an inhabited point on the Argentine side, to replenish our stores and escape from the snowstorms, which became more and more frequent. As most of the men were too exhausted to undertake trying forced marches, I went on in advance, with the two sturdiest of the party, to cross with what speed we might the cordillera that bounds the

upper Rio Cisnes or Rio Frias valley on the south, and reach the adjoining valley of the Rio Senguer, where I could count with certainty on meeting with colonists, or, at any rate, with Indians. I found at the height of 5200 feet a pass still almost free from snow, approached by an easy ascent through beechwood (*Nothofagus pumilio* and *N. antarctica*), or over pampa-like land, crossed the continental watershed between the Rio Frias and the Argentine Rio Ápulen (or Appeleg), and by a second, somewhat lower, pass descended into the valley of the Arroyo del Gato, lying entirely in the pampa country, which I followed to its junction with the broader Senguer valley.

"On April 23rd I reached the small estate of the colonist Antonio Steinfl (an Austrian) on the Rio Senguer, and thence sent back horses and provisions to accelerate the march of the rest of the expedition.

"Till May 1st we were detained in Steinfl's house, partly by a snowstorm that lasted a whole day and came on with a very high barometer and south-east wind. Then we started northwards with a troop of thirteen horses. From the valley of the Rio Ápulen we hurried westwards again to fetch the collections left at a depôt in the upper Cisnes valley. The watershed here lies on an extensive plateau fully 3300 feet high, in which are small hollows converted into pools in the rainy season. To the west the Frias valley, some miles in breadth, with here and there a pampa-like bottom, runs between high uniform ridges into the lofty snowy mountains. Eastwards also extend ranges of respectable height, and covered at the time with snow, which accompany the Rio Ápulen on either side far into the open Patagonian plateau. The interoceanic watershed lies, then, quite within the Andine system, though not on a sharply defined range.

"The homeward journey, as far as the Nahuelhuapi lake, was made, where possible, along the main watershed, until the Rio Teca was reached, where a well-worn track, lying somewhat to one side, leads northwards. The country on the latter part of the route has been fully explored and surveyed during the past summer by numerous boundary commissions, both Argentine and Chilian, so that a reliable cartographical representation of it may be expected shortly.

"On May 20th and 21st we rode through the broad pasture-lands of the Maiten valley, drained by the upper Chubut, and came on the 24th to the southern shore of the Nahuelhuapi lake. It must still be crossed in an open vessel, and the passage occupied three and a half days, owing to strong contrary winds from the north-west. Then the pass of Perez Rosales had to be surmounted, where snow five feet deep lay on the steep flank known as the Cuesta de los Raulies. On June 9th we were again in Puerto Montt."

An expedition under Dr. Paul Krüger and Dr. Ernst Rethwisch returned at the beginning of April to Santiago, after a most successful journey. It left Puerto mouth on January 17th, and examined the coast from lat. 43° to lat. 43½°. In this interval four rivers enter the sea, of which the two northern ones, Yelcho and Corcovado, are the largest; the third, Rio Canef, is only a small coastal stream, while the most southern, Rio Tictoc, is of large volume. Dr. Krüger and his companion ascended the Corcovado in a boat, and travelled forty-five miles in three weeks, rapids, spates, etc., making progress very slow. At length they were obliged to leave their boat and make their way through the forest on the banks. In its upper course the river passes through two clefts only twenty to thirty yards broad, and descends in a succession of falls. On February 25th, an amphitheatre was reached which terminated in a glacier. This is the source of the Corcovado, at the comparatively low elevation of about 2000 feet above sea-level, and it appears that the river, though it discharges a considerable volume of water, has not a long course. Its principal tributaries, named by the explorers Rio

Menor, Rio Verde, and Rio Nevado, also spring from glaciers. Eastwards the basin is bordered by an inhospitable bare cordillera lying about thirty miles from the coast. The expedition ascended several summits, among them the highest in the district, the Cerro Cuatro Piramides, up which they climbed to a height of 4760 feet. The western range of the Andes is here covered with snow and glaciers, and is no doubt the southern continuation of the Cerro Castillos and the Cordillera dos Piramides, and it extends in the direction of the Palena at about 72° W. long. The Staleufu is not identical with the Corcovado or a tributary of it. It would therefore seem most probable that it is the Rio Frio. (See vol. xiii. pp. 62 and 377.)—*Petermanns Mitt.*, Bd. xliv. No. 7.

GENERAL.

Influence of Forests on Rainfall.—M. Claudot, Inspector of Forests, has recently published the results of observations made at Nancy from 1892 to 1896. He finds that the mean annual temperature, five feet above the ground, is a trifle lower—less than half a degree—in a wood than outside. The forest, moeover, renders the temperature more even. Rain is more abundant in a country well clothed with forest, other circumstances being the same. The tree crowns arrest a part of the precipitation, and at least twice as much in summer as in winter; the amount varies during the year in the forest of Haye from 8 to 100 per cent. Nevertheless, owing to the greater abundance of rain, woodlands are better watered than exposed country. The evaporation is greater in open lands, being twice or thrice as great in the cold season, and as much as seven times in summer. Comparing a forest and agricultural district, M. Claudot finds that for 100 mm. of rain that fall on the ground at Cinq-Tranchées, 71 to 81 mm. are received at the agricultural stations of Amance and La Bouzule. Hence there is an advantage of 24 per cent. in favour of the former post, and, since the forest intercepts on an average 13 per cent. of the rain, there remains a net gain of 11 per cent.

Another fact relating to forests has been brought to light by M. P. Ototzki in Russia. In 1891 he found no underground water beneath the forests, though there were wells yielding an abundant supply around them, and again in 1893 he made borings in the forest of Shipof with the same result. In consequence, an expedition was sent out in 1895 by the Economic Society to inspect the forests under the control of M. Ototzki, and visited the forests of Shipof and Semionof (Voronei), the Black Forest (Kherson), and the forests of Kvalynsk (Saratof). It was then found that, where the geographical conditions were the same, the level of the underground water beneath forests was lower than in the surrounding country. At one place in the forest of Shipof the level sank 36 feet in a distance of 208 yards. It was further remarked that the lowering of the level was less in new plantations, where the difference was only 5 feet in 87 yards.—*Ciel et Terre, July 16th.*

Investigation of the Circumpolar Currents by means of barrels.—Commodore G. W. Melville, who took part in the *Jeannette* expedition, holds that the North Pole is surrounded by a cap of solid ice, and that between it and the drifting pack which surrounded the *Jeannette* there exists a channel of greater depth. The vessel was always in shallow water—13 to 36 fathoms, 80 fathoms being sounded only on one occasion. Melville maintains that regular currents, caused by differences of temperature in the water, can only come into existence in seas of at least 100 fathoms in depth, and that, therefore, the drift of the *Jeannette* was due chiefly to the wind. After strong south-easterly winds, which drove the pack to the north-west, had died away, the ship moved rapidly to the south-east, and the mass in

which it was fixed was constantly swinging round. Therefore Melville concludes that it lay in a whirlpool, which, he says, is not found in a regular ocean current. The *Fram*, according to his view, drifted in a deep channel, the edge of which had just been reached by the *Jeannette* when she was crushed. Thus his theory is opposed to that of Nansen, whose observations point to deep water and broken ice right up to the Pole, and is not in accordance with the observations of Koldewey on currents and tides in the Polar Seas.

In order to ascertain the actual drift of the ice in the Arctic regions, Melville proposes to set adrift a number of casks. These casks are in the form of a parabolic spindle, and are made of oaken staves. In one pattern the ends are formed of cones of thick oak connected by a brass rod which passes right through the barrel; in the other the staves are continued to the ends, where they are capped with brass. Through a bung-hole a corked bottle, containing instructions to the finder, can be inserted. The barrels will be painted over with a mixture of pitch and resin to keep them watertight and render them conspicuous. They will be laid on the pack ice, that they may drift with it. Melville proposes to distribute 100 of these casks to the north of Bering Strait in groups of five each, beginning at Herald Island and proceeding along the eastern edge of the pack to the highest possible latitude, probably at about 75° N. lat. and 170° W. long. With the help of the revenue vessels of the United States and the whalers which visit these seas, Commodore Melville will no doubt succeed in putting his plan into operation.—*Globus*, Bd. lxxiv. No. 4.

MISCELLANEOUS.

Mr. A. Silva White is writing a book describing his recent journey to the Siwa Oasis and the archæological discoveries he made there.

The British cruiser *Mohawk* has taken possession of the **Santa Cruz Islands**, south-east of the Solomons. Their area is nearly 400 square miles, and their population about 5000.

The **Antarctic expedition**, equipped by Sir George Newnes, set sail at the end of last month under the conduct of Mr. C. E. Borchgrevinck in the *Southern Cross*, its immediate destination being Hobart Town.

The **average duration of life** is greatest, namely 50 years, in Scandinavia. In England it is 45 years 3 months, in Belgium 44 years 11 months, Switzerland 44 years 4 months, France 43 years 6 months, Austria 39 years 8 months, Prussia and Italy, 39 years.—*Deutsche Rundschau*, Jahrg. xx. Heft 11.

Lieut. Peary sailed from Foulke fiord in August. He will endeavour to land at Sherard Osborn fiord, and the *Windward* will then return home, if not caught in the ice. By the beginning of the summer of 1899 the explorer hopes to reach the northern extremity of Greenland and be ready to push forward to the Pole, but if the season be unfavourable he will establish his Eskimo colony and wait till 1900 or 1901.

In *Petermanns Mitt.*, Bd. xliv. No. 7, Dr. Oscar Baumann reports a new crossing of Africa. This journey has been accomplished by the troublesome sand-flea, known as the **jigger**. It is said to have arrived at the west coast (Ambriz) in sand ballast from Brazil in the year 1892; in 1885 Dr. Baumann found it on the lower Congo and at Stanley Pool, while it was then unknown on the Upper Congo. The Stanley expedition is said to have brought it to the Victoria Nyanza district, and Dr. Baumann observed it on the west bank of the lake in 1892. In 1895 it was

at Mpwapwa: in 1897 it reached the coast towns of Bagamoyo and Pangani, and now it is fairly common in the town of Zanzibar. It is not improbable that this pest may continue its journey eastwards into Southern Asia.

Five years ago the administration of the Congo State decreed the construction of a telegraph line from Boma to Tanganika lakes. It is actually finished almost to Stanley Pool, and the section from Leopoldville to Kwamouth is under construction. Beyond Kwamouth the line will follow the direction of the river to Nyangwe or Kasongo, and by Manyema and Ugua will reach Towa on Tanganika, a little north of the outlet of the Lukuga. While the line is being pushed rapidly forward from the west, a commencement will shortly be made at the eastern end. An expedition under Mr. Mohun, formerly United States Consul on the Congo, has set out for the east coast of Africa. It will ascend the Zambesi and Shiré, and by Lake Nyassa and the Stevenson road will reach Lake Tanganika, where it will commence operations at Towa at the beginning of next year. The length of line from Towa to Kasongo or Myangwe will be about 185 miles.—*Le Mouvement Géographique*, July 31st.

The ruins of Timgad stand about fifteen miles as the crow flies to the south-east of Batna, Algeria. Timgad is the ancient Colonia Marciana Trajana, which was founded after the victories of Trajan over the Parthians. It stood at the intersection of six Roman roads, and was a prosperous city, especially from the time of Trajan to the reign of Constantine, but the rise of the Donatist heresy marks the commencement of its decadence. Its territory was ravaged in 408 A.D., and again by the Vandals in 429, and the town itself was devastated in 553 after the victory of Belisarius over the Vandals. Finally, in 692, it was burnt by the Berber inhabitants when retreating before the Arabs, and was never subsequently rebuilt. The excavations recently made have converted Timgad into an African Pompeii. Among the most remarkable edifices are the triumphal arch, the capitol, the basilica of Gregory, the Byzantine fort, the baths, theatre, and forum. M. A. Ballu, in his report on the work accomplished in 1897, states that the *Cardo maximus*, the principal approach, has been cleared, and that the columns on the triumphal road, the *Decumanus maximus*, have been reconstructed, as well as the northern portico. Columns have also been re-erected in the forum.—*A Travers le Monde*, No. 25.

On April 13th the Hull Scientific and Field Naturalists' Club met to discuss the origin of the Humber mud. The matter brought down by the Ouse and Trent is insufficient to account for the rapid growth of sand and mud banks and even dry land. Reed's Island, between North and South Ferriby, twenty-five years ago comparatively small, is now some hundreds of acres in extent, and feeds a large number of cattle. Besides, the rivers are comparatively clear, and deposit the small quantity of detritus they do transport on their own banks or on alluvial flats. It is also noticed that the water near the mouth of these rivers is muddier when the tide is flowing up them, and this suggests that the mud may be brought in from outside. The waters of the North Sea are continually washing particles of rock and sand southwards, and the Rev. E. M. Cole and others have proved that the cliffs from Bridlington to Spurn Point are being eroded at an average rate of seven feet a year. Much of the eroded matter is carried past the Humber mouth to the Wash and Lincolnshire coast, but part of it is no doubt carried up the Humber by the tide, and when the winds are strongest and the erosion most severe the inrush into the Humber is likewise greatest.—*Natural Science*, August.

NEW BOOKS.

Through Unknown Tibet. By Captain W. S. Wellby, 18th Hussars. London: T. Fisher Unwin, 1898. Pp. 446. *Price* £1, 1*s*.

The strain upon the manhood and military resources of Great Britain, which the maintenance in India of a large European force imposes, is an argument which has been urged against our empire there by Little Englanders. If the argument has any weight at all, it is more than counterbalanced by a consideration of the many advantages derived by our army, and more especially by its officers, from employment in India. From a professional and practical point of view there is no better country in the world for soldiering than India; and among the subsidiary advantages of service there, not the least important is the opportunity and leisure which it offers within India itself, or in the mountainous and wild regions which border it on its continental side, for the pursuit of sport and adventure, calling forth the manly qualities of those engaged in them. There has been abundant exemplification of this in the many books of sport and adventure written, and papers of exploration read, during the last twenty or twenty-five years by Indian officers. In the book before us we have another instance. *Through Unknown Tibet* is the record of a journey of over eight months' duration in 1896, made across Central Asia from Kashmir to Pekin by Captain Wellby of the 18th Hussars, and Lieutenant Malcolm of the Argyll and Sutherland Highlanders (regiments quartered in India), with Duffadár Sháhzád Mír of the 11th Bengal Lancers as surveyor, and three Ladákhis.

Captain Wellby's story is well worth reading as a tale of adventurous travel. It is instinct with the cheery enthusiasm which carried the travellers through many situations trying to the temper and depressing to the spirits. The author disclaims any merit of literary style or scientific research and discovery. But he and Mr. Malcolm kept a regular and careful log of their journey, with observations of position, distance, altitude, and climate; and in a simple and graphic manner the book presents to us descriptions of some of the physical features of the regions traversed, and of many exciting, amusing, and pathetic incidents. The reader will not fail to admire the pluck with which the travellers met, and the readiness with which they overcame, the difficulties encountered. Among these were the carelessness, disloyalty, and (on the 1st of August, in E. longitude 89½°) desertion of more than half of their followers; the gradual loss from fatigue and cold of their riding and baggage animals (till finally out of forty-one only three were left), and the enforced diminution of their equipage and stores; the rough and arid nature of the elevated country traversed, its extremes of heat and cold, its rapid changes of temperature, its weather broken by storms of snow and rain and high winds; and lastly, the disappointment, week after week, of the hope of coming across nomads from whom to obtain information about the country in front of them, and food and transport as their own stock and stores began to wear away. Fortunately, although not without anxiety on the subject, the party seems never to have been seriously short of food. At times, in the alkaline tracts, through which they passed, they were much distressed by the difficulty of finding potable water.

Our travellers doubtless realised, through hard experience, the defects in the plans of their enterprise. One or two of these are obvious from the narrative. They started with too large a body of dependants, and consequently of baggage and baggage animals. Of nearly all of their followers they knew nothing, except,

possibly, that they belonged to a class upon which, in real hardship and danger, little trust could be put. The number of the men not only increased the risk of some loss of human life; it served also to foster laziness, discontent, and want of discipline among them. Three of the men completed the return journey to India, through Pekin and by sea, along with Captain Wellby and Lieutenant Malcolm, and the book closes with a warm acknowledgment of their steadfast and faithful service. A fourth man was sent back from Lan-Chau-Fu overland to Ladákh, and arrived safely. Of the rest of the company, two had to be left by the way, no doubt to die; and five disappeared in the wilderness and have not, apparently, been heard of since. Of the baggage and riding animals three survived the journey. This heavy expenditure of life must give some pause to rejoicing over the success of the expedition.

As is appropriate to this journal, some sentences may be added in regard to the geographical results of the journey, which, however, were not altogether novel or important. The section of the journey which has some fresh geographical interest is that across Northern Tibet from the borders of Ladákh to the Koko Nor. Leaving Ludhkong, at the head of the Pangong lake, on the 34th parallel of latitude, and at an elevation of 14,000 feet, on May 14th, the travellers rarely encamped at a lower altitude than 15,600 feet until the beginning of September, when the country began to slope down eastwards to the level of the Koko Nor (10,200 feet). Six marches beyond Ludhkong they crossed the Napu-Lá, 19,000 feet, apparently the highest of the many passes surmounted on the journey. The ranges in this region are connected with the Karakoram. They then made their way through the trackless Chang-Tang, never before crossed in this direction by Europeans, until towards the end of July they struck, in E. longitude 88°, various streams which feed the headwaters of the Yang-tse (Ma-chu) and Hoang-ho. The Chang-Tang is a desolate wilderness, exposed to great extremes of heat and cold, almost rainless, containing many salt lakes and marshes, and incapable of sustaining nomad life. In long. 97° E., the expedition turned northwards over the Burhan-Bota, an eastern extension of the Kuen Lun, into the Tsaidam. It was not till September 6th (E. long. 95°) that they came to the caravan route from Lhasa to Tankar, and fell in with the annual caravan of Tibetan traders. On September 26th they descried to the north of Barong an encampment of Mongols, by whom they were well received and conducted to the Koko Nor, whence in two days they reached Tankar, the frontier town of China (Kansu).

In conclusion, it may be noted that Captain Wellby gives an interesting account of a visit paid to the great Lamaist settlement at Kumbum, near Lusar, and of interviews with Mína Fu-yeh, a leading Buddha there. He has likewise recorded at some length, from information given by Mr. Ridley of the China Inland Mission, with whom he and Mr. Malcolm stayed at Hsi-ning, the history of the Salár Mohammedan rebellion in Kansu in 1895-96. Many traces of the desolation wrought in these disturbances, which had only recently been suppressed, the travellers saw for themselves.

The book is nicely illustrated from kodak pictures taken by Captain Wellby, and it is very well got up as regards type, printing, and binding.

Twenty-five Years in British Guiana. By Henry Kirke, M.A., B.C.L. Oxon. London: Sampson Low, Marston, and Co. 1898. Pp. 364.

British Guiana, our only colony on the South American continent—a colony of large but very partially developed resources—was little known at home until President Cleveland sharply drew attention to its existence a few years ago by his

very warm espousal of the cause of the neighbouring state of Venezuela in a boundary dispute which had been smouldering for a long time previously, but is now relegated happily to arbitration. The author of the book before us has resided twenty-five years in this colony, holding the office of a county magistrate, the executive duties of sheriff of the county being, by a rather primitive arrangement, tacked on to his magisterial functions. He has also, he tells us, acted as a judge of the Supreme Court, and as attorney-general, and he was employed for some time at Calcutta in collecting and shipping to Guiana East Indian labourers, under the system of Government immigration which prevails in the colony.

During his service, he has come in contact with many sorts and conditions of men, and the volume, which is professedly "Recollections," is a sort of record of his experience. It consists mainly of a collection of anecdotes around which are grouped observations on related subjects. In this way the author touches lightly on such matters as the geographical aspects of the colony, society, the different races which make up the population, mosquitoes, frogs, burials, church endowments, the local bar, the Georgetown Club and its hospitalities—which seem apt to be more profuse than wise—horse racing and other amusements, the vegetation, wild animals, criminal statistics and strange developments of crime, the sugar and other industries. There is no methodical arrangement, except that a chronological thread seems to run through the anecdotes. A good many of them relate to crimes, of which Mr. Kirke has officially had cognisance, and some are rather gruesome; in others he describes adventures and high jinks, in which the fun seems to have been fast, to say the least. He states a clear reason for the depression in the sugar industry, under which Guiana, in common with our West India Island colonies, is at present suffering, viz., that notwithstanding an immense expenditure in labour-saving machinery, and strictest economy in every direction, the cost of production is far above the price to which competition has forced down the market-value of the commodity; the remedy, in his opinion, is a small duty on all bounty-fed sugar imported into England. He considers that a prosperous future is before the colony if fairly treated. The handling of the subjects dealt with is rather sketchy than serious, but Mr. Kirke shows a good deal of shrewdness, writes in a bright conversational style, and although an ex-government official, seems entirely cheerful, and without any personal grievance. The book contains a map of the colony and a number of illustrations.

Wir Framleute. Von Bernhard Nordahl. *Nansen und Ich auf* 86° 14′. Von Lieutenant Hjalmar Johansen. Leipzig: F. A. Brockhaus, 1898. Pp. 519.

The narratives of Herr Nordahl and Lieut. Johansen, which are published as a supplement to Dr. Nansen's *In Nacht und Eis*, are pleasantly written and, by relating additional incidents, help to make more complete the picture of life in the Arctic regions sketched by the leader of the expedition. They contain little new scientific information, which, indeed, is only what one would expect.

One very interesting fact is mentioned by Herr Nordahl, namely, that a line two or three hundred yards long let down into the sea, with a net attached to collect organisms, did not move with the vessel, so that the drift of the vessel was indicated by it. Hence, he concludes that the motion is due solely to the winds, and that there is no current extending to any considerable depth beneath the surface; and in this view he is supported by Lieut. Johansen. We also learn from these narratives that the long sojourn in the Polar regions had a trying effect on the crew of the *Fram*, rendering them irritable and depressed, and that in the third

winter their bodily health began to suffer. It is not, therefore, by any means certain that even the most robust Europeans can live an indefinite length of time in the Polar regions, as has been affirmed, most emphatically, perhaps, by Lieut. Peary. No doubt, in the case of the crew of the *Fram*, the complaint they suffered from was to a great extent mental, their chances of escape depending on the drift of the ice, and their anxiety became more intense at the end of the third winter as their hopes of reaching home rose and fell with the changes of the wind. Peary and his companions, on the other hand, could always look forward to a return home in the summer.

The volume is profusely illustrated: some of the views have already appeared in *Farthest North*.

La Jeune Grèce. Par Marie Anne de Bovet. Paris: L. Henry May, 1897. Pp. 299. *Price* 3 *fr.* 50 *c.*

After writing excellent accounts of her travels in Ireland and Scotland, Mme. de Bovet now describes a voyage among the Isles of Greece and through Greece itself ten months before the recent war. Full of enthusiasm for the Greeks and their beautiful country, the authoress chides her countrymen for the small interest they take in anything outside France. "The contempt shown by the French in general, and by the Parisians in particular, for foreign things is the result partly of foolishness, and much more of ignorance. They confine themselves willingly to the small portion of the civilised world which they know, and think that dispenses with their knowing the rest. Whoever has visited those exquisite shores, stretching from the Ionian Islands to the Bosphorus, knows that they vibrate with passionate nationalities, ardent patriotism, growing vitality and energy, just as much as does the peninsula of the Balkans, that corner of Europe still so incompletely organised on account of the confusion caused by Ottoman invasion."

Islands of the Southern Seas—Hawaii, Samoa, New Zealand, Tasmania, Australia, and Java. By M. M. Shoemaker. New York and London: G. P. Putnam's Sons, 1898. Pp. 277. *Price* 10*s.* 6*d. net.*

In this well written and prettily illustrated book the author records the opinions of a practical American traveller on several important islands. As Hawaii is so often referred to at present, we may give the conclusion he arrived at regarding its proposed annexation by the United States: "The expense of maintaining a coaling-station at Hawaii would be greater than to fortify our Pacific ports. Naturally the few sugar planters and their satellites are crying for annexation, because they fear that Americans will come to their senses, and abrogate the present treaty which grants full entry to Hawaiian sugar. It is therefore not surprising that we find the same faction advocating in Congress Hawaiian annexation, and demanding increased favours for the Sugar Trust. Thoughtful Americans, who are not interested in the Sugar Trust and in the political appointments from Washington, cannot fail to think that the correct solution of the Hawaiian problem would be for the United States and Great Britain to unite in guaranteeing autonomy to the Islands, in consideration for which Hawaii should give a neutral coaling-station for the two nations, and free entry for British and American products." Mr. Shoemaker does not indicate what other nations interested in Hawaii might have to say to this Anglo-American arrangement.

Across the Sub-Arctics of Canada, a Journey of 3200 Miles by Canoe and Snowshoe through the Barren Lands. By S. W. Tyrrell, C.E., D.L.S. Including a List of Plants collected on the Expedition, a Vocabulary of Eskimo Words, a Route Map and full Classified Index. With Illustrations from Photographs taken on the Journey, and from Drawings by Arthur Heming. London: T. Fisher Urwin. Pp. vi + 280. *Price 7s. 6d.*

Though the highest latitude reached by the members of this expedition was only 64° 48′ N., they had many experiences of which an Arctic explorer might feel proud. Imminent danger of death from starvation on the ice-bound shore of Hudson Bay when on their way home, after many a hairbreadth escape in running the rapids of the rivers, which they followed in their journey to the north and east, was among the exciting incidents of this expedition to explore the Barren Lands of Canada, which the author undertook in 1893 in company with his brother. The latter, a member of the Canadian Geological Survey, has already published the chief geological results of the expedition in the reports issued by the Geological Survey Department of Canada for 1893. Of general interest is the author's statement that the country between Dobaunt Lake and Baker Lake seems full of mineral wealth. He says, "The time must come—it may not be far distant—when the prospector and the miner will occupy all this vast field of mineral wealth." Baker Lake was reached more than a hundred years ago from Hudson Bay by two small vessels which passed through Chesterfield Inlet and the two rivers flowing into it from Baker Lake, and the brothers Tyrrell have ascertained the fact that with the exception of perhaps one spot—the canyon rapid north of Dobaunt Lake—the whole river from the height of land to Baker Lake might be navigated by river or York boats with comparative ease. At the rapid a portage could be made, or possibly a navigable channel might be discovered. The author has embodied in his account of the expedition a very interesting chapter on the Eskimo, whom he visited on a former occasion. Botanists will be grateful for the classified lists of plants found in the Barren Lands.

Attraverso l'America Meridionale. Escursioni nella Pampa, la Patagonia, la Terra del Fuoco, il Paraguay, Salto del Guaira. Di G. A. Raggi. Illustrato da 48 Incisioni e da una Carta. Milano: Casa Editrice Doctor Francesco Vallardi, n.d. Pp. 149.

The most interesting spot our author visited, the Guaira falls of the Parana river, had been described to him by one of the few European travellers who had gone there, as equal in grandeur to Niagara. The journey from Assuncion, evidently not nearly so enjoyable as a mere pleasure-seeker would wish, took several weeks, and when he reached the falls he had only just time to sketch them, as lack of food and a superabundance of mosquitoes compelled him to beat a hasty retreat. The latter inconvenience, especially, seems to very seriously interfere with an enjoyment of the sight, since it took our author two months to recover from their bites. The falls, though undoubtedly very grand, are apparently not a match for Niagara. A sail up the Paraguay river in quest of sport proved a failure. When travelling in Patagonia, the author visited a number of sheep ranches, and if the profit and loss account which he gives of sheep farming in those parts is correct, it must be a very profitable business.

Karawanen-Reise in Sibirien. Von Kisak Tamai aus Japan. Berlin: Verlag von Karl Sigismund, 1898. Pp. 163.

The chief interest of this journey is that it was made with a tea caravan. The tea is brought from Shanghai to Vladivostok by steamer, and is then conveyed by

the Amur and other rivers to Irkutsk, where it is taken over by the caravans, which make the journey to Tomsk in twenty-five to thirty days. The author had much to endure from the weather, the journey being made in winter, and also from loss of sleep.

Appended to this narrative is an account of a circumnavigation of the globe made by some Japanese, whose vessel was driven out of its course in 1789, and carried to the Siberian coast. They were rescued by Russians, and, after spending fifteen years in Siberia, were conveyed in a Russian vessel round Cape Horn to their native land.

The author of this pamphlet has commenced the publication, in Berlin, of a periodical named *Ost-Asien*.

Benzert. Prag: Heinr. Mercy, 1897. Pp. 69.

Very few would recognise under this title the Tunisian seaport commonly called "Bizerta." Of Phœnician origin, the town was termed by the Romans Hippo Zarythus, or Diarrhytus. In 662 it fell into the hands of the Moors. Assaulted at intervals both by Spaniards and Venetians, it ultimately in 1881 was taken possession of by France. Its spacious harbour has now been enclosed, and can accommodate hundreds of ships. Its attractiveness to visitors is summed up by the author of this splendid monograph in the words:—"Yes, it is Venice with its witchery, without its wealth of architecture, but with all the poetry of the East."

The extensive and fully equipped new harbour of Bizerta was officially declared open on 1st July 1895, and next year two French ironclads safely traversed its whole length. Two trains leave daily for Tunis, which is reached in two and a half hours. The French are deservedly proud of their work at Bizerta, and of having created there "an excellent harbour of refuge which will eventually become an important commercial centre." Numerous sketches by the author complete this admirable account of Bizerta and environs.

Thermo-Geographical Studies. General Exposition of the Analytical Method applied to Researches on Temperature and Climate. By G. L. Madsen. Published at the expenses of "Carlsbergfondet," Copenhagen: G. E. C. Gad, 1897. Pp. xxii + 142, and about 100 pages of appendices in the form of tables. *Price* 30*s. net.*

This elaborate and important work was awarded the Hodgkins Medal, 1895, by the Smithsonian Institution, Washington. It is an attempt to obtain, by a sound mathematical treatment of the meteorological data for the globe, formulæ and equations representing the important features of temperature and climate. For example, by use of the laborious method of least squares the author deduces the following formulæ for the mean annual temperatures in the northern and southern hemisphere, in latitude ϕ:—

Northern, ... $57{\cdot}1579 \cos\phi + 33{\cdot}5511 \cos^2\phi - 7{\cdot}1746$
Southern, ... $18{\cdot}0668 \cos\phi + 50{\cdot}9531 \cos^2\phi + 11{\cdot}0219$

each in degrees Fahrenheit. These expressions require modification for regions within 10° of the equator, Mr. Madsen discarding the so-called *thermal equator* in parallel 10° N. in favour of an equatorial zone (10° S. to 10° N.) with a practically uniform temperature throughout. The mean temperature of the earth's surface comes out 15°·3 C. or 59°·54 F.; while the mean temperature for the northern hemisphere is nearly one-third of a degree Fahrenheit higher than for the southern. The author then goes on to give equations and formulæ for particular regions or

places of the earth's surface. This leads to the introduction of the quantity known as the "annual thermo-geographical component," defined as the difference of the mean annual temperature of a place and the normal mean annual temperature due to the latitude of the place. Particularly full is the discussion of the North Atlantic, in which the influence of the Gulf Stream is so important a factor. In the treatment of the difficult question of the annual march or movement of temperature, the so-called "thermal dynamo-cosmical factor" is introduced, depending for its definition on the recognition of the well-known retardation of meteorological behind cosmical season. There is one factor for each month; and its sign is positive in the summer months and negative in the winter months. Another important coefficient is the mean variation or difference between the normal march of mean monthly temperature and the actual march of the mean monthly temperature at any given place. This mean variation, or "thermo-geographical coefficient, MV," indicates the character of the climate, gradually increasing in value through the seven classes of climate, namely, tropical and extreme insular, extreme coast, normal coast, normal continental, central continental, extreme continental, and polar climates. The manner in which MV increases as we pass across a continent is well shown in the diagrams of Plates ii. and iii. In terms of these quantities or coefficients, the mean annual temperature, the dynamo-cosmical coefficients, and the mean variation, the normal monthly temperature of any particular place is at once determined.

In such a brief account it is impossible to give any true idea of the time, labour, and skill which must have been expended in calculating these coefficients; and, although the statistics for large tracts of the earth's surface are very incomplete and in many cases non-existent, Mr. Madsen is probably right in regarding his work as showing very approximately the existing thermal conditions of our globe. There is only one small criticism we feel inclined to make, and that is with reference to the style, which is frequently involved and obscure. The English is stiff at the best, and occasionally ungrammatical. These flaws, however, in no way detract from the intrinsic merit of the book.

Demeter und Baubo. Versuch einer Theorie der Entstehung unsres Ackerbaus von Ad. Hahn. Berlin: Lübeck, Selbstverlag des Verfassers, 1896. Pp. 77.

In this small work the author gives, in a more condensed form, the substance of the argument developed in his larger volume, *Die Haustiere*, published in 1895. It is very generally held that man, in his passage from savagery to civilisation, has successively passed through a hunting, pastoral, and agricultural stage. The author disputes this theory. Earlier than any of these periods, we have to imagine a time when the omnivorous savage picked up and devoured everything that was edible; and at this stage it seems to be implied that he possessed no instruments whatever. Roots and seeds were among the edible things, and in course of time man, without ever becoming a hunter or a fisher, gradually observed that by dropping a seed or a bit of root into the ground, it grew and multiplied. Eventually this process developed into the form of agriculture in which the ground is tilled with a rude sort of hoe or mattock, the plough being unknown. The new agriculture that included the use of the plough and of draught oxen arose in one part of the globe only, and thence was diffused over a great part of Asia, North Africa, and Europe. The starting-point of the new civilisation was the lower valley of the Euphrates, and the basis of it reposed on certain religious ideas. At a very early

period, the recurrent phases of the moon had attracted attention, and both the growth of vegetation and the menstrual periods had been brought into connection with this luminary. The moon, therefore, began to be regarded as a goddess of child-birth, fertility, and the embodiment of the female principle. In honour of the goddess, herds of wild cattle, the horns of which seemed to resemble the horns of the moon, were driven into enclosures, and kept there as sacred animals. Besides occasionally sacrificing these cattle, milk drawn from the cows was also poured out as a libation to the divinity. Hitherto milk had never been employed as an article of diet, for the simple reason that animals in a wild state are only in milk when calving, and have only enough for their young. But as cows became accustomed to be handled and milked by man, originally for the purpose of drink-offerings only, they very slowly acquired the milking capacity that distinguishes the domestic from the wild cow. Till this structural change had taken place, no animals could be used for milking purposes, and no pastoral stage, with a dietary chiefly of milk products, could possibly arise. The worshippers of the great goddess, though still without ploughs, used spinning whorls, and by passing a small stick through a pair of whorls, they made pairs of miniature wheels. Out of these was ultimately evolved a small four-wheeled wagon, on which they placed an image or symbol of the goddess, and transported it from place to place. Then the idea struck them that the wagon might be enlarged, and as it was only used in the cult of the goddess, some of the sacred oxen were yoked and trained to drag it. The use of oxen for draught suggested the idea that they might equally well be attached to a modified form of the mattock held upright. This led to the invention of the plough, and the act of ploughing became a religious act, performed with the aid of the sacred cattle. The castration of the oxen was also based on a religious notion connected with the worship of the great goddess. Though we cannot assent to the whole of Herr Hahn's theory, many of his suggestions and observations deserve careful consideration.

Religiões da Lusitania na parte que principalmente se refere a Portugal. Por J. Leite de Vasconcellos. Vol. i. Lisboa: Imprensa Nacional, 1897.

Any attempt to define the religious ideas of the prehistoric past is obviously premature, and the learned Director of the Portuguese Ethnological Museum has not ventured to do so. But with due caution and reserve he enumerates the various classes of objects found in prehistoric sepulchres in Portugal, describes the modes of disposing of the dead, and after comparing these with modern examples found among the lower races, he arrives at certain broad conclusions, which, if not absolutely certain, are undoubtedly reasonable.

He combats the view of M. de Mortillet that palæolithic man had no religious ideas and made no use of amulets. He adduces modern examples to show that amulets cannot always be distinguished from ornaments. For instance, the people of Lunda in West Africa wear round their arms a thread strung with beads to counteract the evil eye. The pierced teeth of animals, so frequently found with palæolithic and neolithic remains, may have been used as amulets quite as much as for ornament. In Italy they are still hung round the necks of children to preserve them against the dangers of dentition and of witchcraft. Amulets may also degenerate into mere ornaments. The eagle's feather, with which the Tyrolean hunter decorates his hat, was formerly placed there to give him a piercing eye, and courage in danger. Small *plaques* of schist or limestone, usually of trapezoidal form, either plain or rudely engraved with a human figure, and provided with one or more holes of suspension, are more likely to have been amulets or fetiches than

ornaments. If these *plaques*, beads, and pierced teeth are really amulets, it implies that prehistoric man, even in palæolithic times, protected himself against evil influences by such expedients, and therefore had an inkling of immaterial or superhuman beings of some sort.

In the period of the kitchen-middens, which is placed between the palæolithic and neolithic periods, the dead seem to have been regularly inhumed with care and with many objects of human industry beside them. Such a practice involves a belief that something survived after death and continued to exist. Though such an idea is not necessarily a religious one, it is possible that a cult of the dead existed in prehistoric times. Evidence for a belief in spirits may find support in the practice of trepanning. The operation was performed both before and after death. In lifetime it was done probably as a cure for epilepsy, and after death either to make amulets from the excised discs of bone, or to give an exit to an evil spirit lodged in the skull. The almost complete absence of fish-bones in the prehistoric cave at Peniche, quite close to the sea, may indicate that fish were held sacred and therefore were not eaten. A crescent incised with other ornaments on a stone found in a grave near Cintra, taken in connection with an undoubted cult of the moon in the Roman epoch, may possibly point to a similar worship in earlier times. The very frequent orientation of dolmens towards the east might be taken to indicate a worship of the sun, though of course the practice may be otherwise explained. In Portugal, as in Great Britain and many parts of Europe, cup-markings are sometimes found on dolmens or on isolated rocks, and belong to the neolithic period. Mr. Vasconcellos rejects the explanations often propounded, and adopts the more rational hypothesis that they were connected in some way with the cult of the dead and the worship of stones.

Taking everything into consideration, he concludes that the notion of worship in prehistoric times in Portugal may have embraced a rudimentary priesthood; sacred places (cemeteries); ceremonies (funeral); worship of the dead; the use of amulets; symbolical instruments and urns; idols or fetiches of animals and of man; markings sculptured on rocks and stones.

This volume is one of several issued by the Lisbon Geographical Society in connection with the Vasco da Gama celebrations.

John and Sebastian Cabot. The Discovery of North America. By C. Raymond Beazley, M.A., etc. ("Builders of Greater Britain" Series.) London: T. Fisher Unwin, 1898. Pp. 311. *Price 5s.*

Mr. Beazley, whose works on historical geography are of a high order, has in this new volume carefully discussed the numerous doubtful points connected with the voyages of the Cabots, and the share of Sebastian Cabot in those of his father and in other enterprises. While acknowledging the insincerity of Sebastian, he does not regard him as so thorough an impostor as Mr. Harrisse depicts him. All the evidence is clearly placed before the reader, and carefully weighed for the purpose of throwing light on the real history of the discoveries of the Venetian voyagers. As to the "landfall," which has given rise to so much recent controversy, the author wisely does not commit himself to any specific *locus*, but remarks that "it will be enough to say that Cape Breton may be accepted as a southernmost point for the Cabotian landfall, as one limit of a line of coast, somewhere in which the adventurers of 1497 must have touched the New World—but no more." His argument, however, that, "as the weather is likely to have been clear at midsummer," therefore Cape Race was probably visible, is not absolutely convincing, considering the prevalent foggy character of the Newfoundland coast.

The Growth and Administration of the British Colonies, 1837-1897. By Rev. W. P. Greswell, M.A. ("The Victorian Era Series.") London: Blackie and Son, 1898. Pp. 253. *Price 2s. 6d.*

"The series is designed to form a record of the great movements and developments of the age, in politics, economics, religion, industry, literature, science, and art, and of the life-work of its typical and influential men." This volume gives first the history of our colonial "system," or rather lack of system, and brief notices of the men and societies that were the pioneers of colonial progress. Then follow accounts of the growth of the great colonial groups, and of their political constitutions. In a concluding section there is pointed out the importance of closer union between the different portions of the British Empire. "The growth of the idea of federalism and the general tendency of the colonies to be united more closely with one another, and also with the mother-country, is one of the most marked political features of the latter years of the Victorian era." "Federalism, in its modern sense, should be the child of constitutional development, and the crowning product of popular representative government." This book should prove of value as a help towards the formation of a sound and well-informed public opinion upon this question, which is certainly one of the most important of the day.

Types of Scenery and their Influence on Literature. The Romanes Lecture, 1898. By Sir Archibald Geikie, D.C.L., F.R.S. London: Macmillan and Co., 1898. Pp. 59. *Price 2s. net.*

Whilst the facts of geology have often been made attractive by Sir Archibald Geikie's skilful pen, in this lecture he breaks entirely new ground by showing how exquisitely our English and Scottish poets have described the scenery of their native land. Cowper, Thomson, and Burns are quoted as examples of poets portraying Lowland scenery, whilst the Border Balladists are cited in connection with the Uplands, and Ossian, Scott, and Wordsworth in descriptions of the Highlands. Sir Archibald says Thomson's "Winter" was written at Barnet, and that his "verse was turgid, full of latinisms, and sadly lacking in the simplicity and directness which the subject required." There is a tradition that Thomson's "Winter" was written at Dryburgh on the banks of the Tweed, and certainly no exception can be taken to such description as that of a river in flood, when he tells how

"It boils, and wheels, and foams, and thunders through."

Politische Geographie. Von Dr. Friedrich Ratzel, Prof. der Geographie an der Universität zu Leipzig. Mit 33 in den Text gedruckten Abbildungen. München und Leipzig: R. Oldenbourg, 1897. Pp. xx + 715.

The book under review is not one of those text-books on political geography which used to disturb the serenity of our school-days. The object of Professor Ratzel in writing his *Politische Geographie* was to inquire into the principles which govern the relations between Geography and Politics. It is not, of course, possible, in a short notice, to give a complete idea of the contents of the volume. Suffice it to say that no fact of any importance bearing on the geographical features of the globe in their relation to politics has escaped the Professor's searching eye. The wealth of facts which the author adduces from every quarter of the world, in illustration or support of his propositions, is truly astonishing, and is equalled by the abundance of quotations from authors, known and unknown, writing on history,

politics, and geography. If politicians had always paid due attention to the geographical aspects of political problems, the latter would, in many cases, have been solved in a different and more satisfactory manner, and it was high time that a work like Professor Ratzel's should be undertaken. But we venture to doubt whether many men in active life will feel inclined, even if they have the time, to read a book of the size of *Politische Geographie*. The omission of commonplace truths, and condensation altogether would, we think, make the work much more attractive and useful to the general reader.

Géographie. V.—L'Expansion Européenne.—Empire Britannique—Asie—Afrique —Océanie. Par le Colonel Niox. Troisième édition, avec cartes et croquis. Appendice mis au courant jusqu'à la fin de l'année, 1897. Paris: Ch. Delagrave and L. Baudoin, N.D. Pp. 472–59.

The fifth volume of the *Géographie* by Colonel Niox deals with the European possessions and protectorates in Asia, Africa, and Australasia. After a brief survey of the British Empire, the author gives a short but sufficient description of the physical features of the different countries, sketches the history of their exploration and conquest by Europeans, and deals at considerable length with the political situation of to-day, paying special attention to military questions. A valuable feature of the book consists in the full account it gives of the treaties at present in force. Being carefully compiled and brought up to date by an appendix, it forms a very serviceable book of reference.

In the Introduction, comparing French and English methods of colonisation, the author remarks: "French colonial enterprise has always been marked by the chivalrous character of military adventures rather than by the spirit of commercial speculations. . . . The English policy, on the contrary, is one of self-interest and gain. The English rarely wish to assimilate the populations among whom they establish themselves, nor aspire to making them happier by civilising them and withdrawing them from their oppressors. Their principal object is to transform their subjects into consumers of English goods, etc." In justice to our author, we wish to point out that all through his book we have frequently met with passages in which he fully acknowledges the benefits of British civilisation.

The Wealth and Progress of New South Wales, 1896-97. By T. A. Coghlan, Government Statistician. Tenth issue. Sydney: W. A. Gullick, 1897. Pp. 1015. Index and map.

A detailed review of this volume is impossible; the ground covered is too great, too vast. As the author says in the preface, the difficulty always experienced in making a work of this kind interesting to people outside the colony, who are not concerned about the details of local affairs, and at the same time useful to those who are engaged in the active life of the colony, is always great. In this case it has been very successfully accomplished. A good historical sketch of the colony is given, its physical configuration, climate, geological formation, fauna and flora, as well as constitutional government, are sufficiently dealt with; and then we have chapters dealing with the various industries, population, and vital statistics, as well as tabular accounts of the social condition of the people, law and crime, food, cost of living and prices. Finally, public and private finance are dealt with, and the whole volume forms a mass of valuable information for commercial men and intending emigrants, and must be exceptionally useful in the colony itself. We think that this issue is a considerable improvement on any of the previous ones.

Contributions to the Early History of New Zealand. (*Settlement of Otago.*) By T. M. Hocken, M.R.C.S., etc. London: Sampson Low and Co., 1898. Pp. 202 and Appendices, pp. 140. With portraits and other illustrations. *Price* 14*s.*

We who stay at home do not, as a rule, fully appreciate the early struggles of our various colonies. Did we do so, it would be probably better for us, and would tend to bring about a far healthier and more friendly feeling between the colonies and the mother country than at present obtains. Mr. Hocken has dealt with the fascinating details of the early struggles of the settlement of Otago in a lucid and comprehensive manner. He has spared no pains in what was to him a labour of love, and we read with the greatest interest of the pioneer leaders and their early struggles, and how gradually the colony emerged from all its difficulties. An account, too, is given of the religious history of the settlement. This volume ought to be especially interesting to Scottish readers, as they were intimately connected with the development of Otago. Appendix F. gives the names of all the vessels despatched from Great Britain to the settlement, together with the names of the settlers, and Appendix G. gives the principal events which have happened from 1840 till March 1897. The illustrations are admirable as well as numerous, and we cordially recommend this volume to the notice of our readers, and congratulate the author upon his fascinating work.

A Journal of the First Voyage of Vasco da Gama, 1497-1499. Translated and edited, with Notes, an Introduction, and Appendices, by E. G. Ravenstein, F.R.G.S., Corresponding Member of the Geographical Society of Lisbon. London: Printed for the Hakluyt Society, 1898. Pp. xxxvi + 250.

The Hakluyt Society has made an excellent choice in the book it has published for the fourth centenary of Vasco da Gama's arrival in Calicut, for the *Roteiro* is the only account written by a member of the expedition. The *Lendas da India* of G. Correa, published by the Society in 1869, differs in so many particulars from all other accounts, that it is impossible to believe that the author wrote from personal knowledge. Mr. Ravenstein has already written a Life of Vasco da Gama, and his general knowledge of historical geography renders him an excellent editor of this work, now for the first time published in English. In the introduction he describes the manuscript of the *Roteiro* now in the public library of Oporto, and discusses the question of the authorship, which he leaves doubtful, elucidates the text with many useful notes, and in the appendices collects a large amount of various information relating to the voyage. The appendix on ancient maps and the list of place-names on that of Canerio, with their modern equivalents, is particularly valuable.

The volume is enriched by several maps and illustrations.

The Year-Book of British Columbia and Manual of Provincial Information. By R. E. Gosnell, Librarian Legislative Assembly and Secretary Bureau Statistics. Victoria, B. C., 1897. Pp. 500.

All our important colonies publish year-books, and it was quite time that one should be compiled for British Columbia. The information that Mr. Gosnell has here brought together is varied and full of detail. To the important industries of the colony, especially gold-mining and fishing, considerable space is devoted, the Klondike district being also described, though not in British Columbia. The departments of government, colonial and municipal, tariffs, fauna and flora, and many other subjects too numerous even to mention, find a place in this book.

Chapters on the boundary question and the seal-fishery dispute with the United States deserve to be specially referred to. They contain complete accounts of the past history and present state of the negotiations.

It is difficult to decide, on the first issue of a book of this kind, what should be included, and Mr. Gosnell found that a great deal of material had to be omitted. Perhaps some of the chapters might have been condensed, and at all events need not be given in full in another edition, which no doubt will soon appear, for the book must prove useful to all who live or are interested in this rapidly progressing colony.

Maps, which would have been more conveniently placed in a pocket in the cover of the volume, and a large number of illustrations, add to its value.

Tide-Tables for Charlottetown, Pictou, and Paul Island, C.B., for 1898. Ottawa : S. E. Dawson, 1898.

One of the practical results of the experiments carried out by Mr. W. Bell Dawson, of the Canadian Tidal Survey, on the tides and currents of the Gulf of St. Lawrence, is this pamphlet, containing tables of tides at certain stations in the south-western part of the Gulf for the months of navigation,—April to November. By the use of time differences the tables may also be used for other stations. Notes are also given on local variations of tides and currents, which, as already shown in notes in the Magazine on Mr. Dawson's work, are very capricious.

South-Eastern France, including Corsica. By Karl Baedeker. Third Edition. Leipzig : Karl Baedeker, 1898. Pp. 322. *Price 5 marks.*

Admirably complete, as all Baedeker's Guides are, there is little left for criticism in the volume before us. We should perhaps have liked a little more space given to the Iles de Lérins near Cannes, and mention made of our renowned Scoto-Irish Saint Patrick, who was educated at their ancient monastery, now restored and occupied by Cistercian monks. The Corsican part of the "Guide" has been revised up to date, but we do not understand why the editor should say "Hired carriages are dear, about 20 fr. per day." Seeing that the Corsican carriages are excellent, have two horses, hold four persons, and are at their hirer's service daily from 8 A.M. to 8 P.M., to stigmatise them as "dear" at about 16s. per day is not just.

A New Pictorial and Descriptive Guide to the Highlands and Islands of Scotland. Pp. xvi + 201. *A Pictorial and Descriptive Guide to Belgium, the Ardennes, and Holland.* Pp. 268. London : Ward, Lock, and Co., N.D. *Price 1s. each.*

These guides are of handy size, and contain sufficient information for the majority of tourists. They have been carefully compiled, and are on the whole accurate. The maps, though good of their kind, do not meet the requirements of pedestrians and cyclists, who now want to know something of the orography of highland districts. The Belgian guide should certainly contain plans of the chief towns.

Cook's Handbook for Normandy and Brittany. London : Thomas Cook and Son, and Simpkin, Marshall, Hamilton, Kent, and Co., 1898.

This handbook is compiled for holders of Cook's tickets. It contains a list of routes for which tickets are issued and a gazetteer of the towns and places of interest. It is also provided with two or three simple maps and plans of towns.

Chamonix and the Range of Mont Blanc. Pp. xiv + 205. *The Valley of Zermatt and the Matterhorn.* Pp. xiv + 224. By Edward Whymper. *Price 3s. net each.*

These are the second and third editions respectively of Mr. Whymper's useful guides, which contain not only instructions to travellers, but a history of mountain ascents, etc. One of them was noticed in vol. xii. p. 660. In the new edition only a few notes are added here and there to bring the book up to date. A very important addition is an index.

On Plain and Peak. Sporting and other sketches of Bohemia and Tyrol. By Randolph L. L. Hodgson. Westminster: Archibald Constable and Co. 1898.

Sportsmen who are choosing a few volumes to take with them to their shooting-boxes on the moors or the deer forests, would do well to include in their list Mr. Hodgson's book *On Plain and Peak.* It is a good description of miscellaneous shooting in Bohemia and the Tyrol, written *con amore* by a keen sportsman, who has an equally keen appreciation of the beauties of nature and a facile pen, with which to depict them to his readers. Sportsmen in Bohemia seem to be content with but a small bag even of birds and ground game, such as would hardly satisfy the average grouse and blackcock shot on the moors of Yorkshire or Perthshire. On the other hand, the difficulties and dangers of chamois hunting in the Tyrol are very much greater than any to be incurred by the most adventurous deer-stalker in Argyllshire or Ross-shire. The illustrations of the book, some of which are by H.S.H. Princess Mary of Thurn, are excellent.

Spain and its Colonies. By J. W. Root. London: Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 1898.

In this brochure of about one hundred pages we have a succinct and well-written account of the rise and fall of the Spanish colonial empire. Details are necessarily omitted, but the main facts are given with sufficient accuracy. The pamphlet has, of course, a special and even a pathetic interest at the present time, when apparently the last remnants of the greatest colonial empire the world has ever seen are to be wrenched from the hands of a power once the greatest, but now almost the weakest, in Europe. The story is full of profound interest, especially to those nations which have embarked of late years in colonial enterprise, and even to those whose colonial experience is ample and ripe. The Anglo-Saxon races are not likely now to fall into the mistakes made by Spain, but it would be rash to predict the same of other nations, where too often bureaucracy and fanaticism predominate over constitutionalism and toleration.

South American Sketches. By Robert Crawford, M.A. London, New York, and Bombay: Longmans, Green, and Co., 1898.

These sketches refer for the most part to the conditions of life in the little Republic of Uruguay in South America. If they are to be accepted as truthful (and we see no reason to doubt their veracity), then Uruguay is by no means a place to be sought even by the adventurous tourist, not to speak of the law-respecting Saxon. Honesty is non-existent, violence and chicanery are general, revolvers "go off of their own accord," as it is euphemistically expressed, and life generally is too exciting for the ordinary traveller. The sketches are easy reading and fairly amusing, although somewhat diffuse and needlessly padded.

REAR-ADMIRAL SIR JAMES CLARK ROSS, D.C.L., F.R.S.

Commander of the British Antarctic Expedition, 1839-43.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE ANTARCTIC.

A Plea for a British Antarctic Expedition.

The Council has resolved to publish an Antarctic number of the *Magazine* of the Royal Scottish Geographical Society, in which the reasons for immediate Antarctic exploration are to be set forth by scientific men. I have been asked to supply a few notes by way of an introduction. I have indeed been asked to appeal to rich and patriotic men at home and in our colonies to uphold the scientific reputation of the country with regard to Antarctic exploration, in the same way that Mr. Mackay Bernard has recently upheld the good name of Scotland by preventing—through a liberal donation—the closing up of the Ben Nevis Observatories.

The British Government has brushed aside the scientific opinion of the country, and has definitely declined to send out an Antarctic expedition at the present time. More recently the British Government has been invited by the Swedish Government to join with other nations in a scientific exploration of the North Sea and North Atlantic, with special reference to fishery problems. Intimation has been sent to Sweden that this invitation must be declined

unless the scientific part of the proposed programme be cut out or subordinated. High considerations of State are alleged to be the reason for these decisions. All our naval men and all our spare funds are required, it would appear, to prepare for possible external enemies. None the less, these decisions are rather humiliating to scientific men, who have long urged that our country should not only take a part, but a leading part, in all scientific researches, and especially in all oceanic explorations.

The *Challenger* expedition may possibly be the last of the long series of voyages of exploration which have brought so much renown to the people of the United Kingdom. The *Challenger* expedition, indeed, seems to have satiated our statesmen and even to have drained the exchequer, for the aid of private funds was necessary to bring the official publications of that expedition to a successful termination.

The conviction that we are, in exploration and scientific research, not doing anything like our best, is much deepened when we compare our present efforts with what is being done in these directions by other progressive nations. Last winter the German Parliament voted funds for the outfit and despatch of a Deep-Sea Expedition for the examination of the greater depths of the Atlantic, Indian, and Great Southern Oceans as far as the Antarctic ice. The steamship *Valdivia*, set apart for this expedition, touched at Edinburgh a few weeks ago, and we had an opportunity of seeing fifteen enthusiastic scientific men working in large laboratories, and surrounded by the most approved apparatus for oceanographical investigation. Oceanography is a science that, at one time, this country had almost made its own; yet what opportunities have been afforded to our younger scientific men of studying deep-sea and oceanic phenomena with improved appliances?

If, again, we wish an example of how effectively the scientific investigation of the ocean may be fostered by the intelligent and liberal employment of private means, we may turn to the United States, where we find Alexander Agassiz

carrying out splendid explorations in many parts of the world at his own expense, and publishing the observations at an annual cost of many thousands of pounds.

At the present moment scientific men in Germany are making arrangements, with the approval and support of their Government, for the exploration of the Antarctic in the year 1900. We have been asked to co-operate, at the same time, in this exploration. The representatives of science in our country can only reply that the British Government has declined to look favourably on any such undertaking, and further, that there is little hope of the necessary funds being procured from private sources, so great is the dead weight of indifference among the general public. Just as in some tropical islands—where the natural supply of food is abundant—men have become mild and docile without rising above the intellectual level of barbarism, so apparently does the vast accumulated wealth of our day enable masses of people to live in ease and comfort and at the intellectual level of the bygone century.

Notwithstanding some brilliant and admirable exceptions, it must be admitted that among our legislators, officials, and well-to-do classes there is very little real appreciation of the importance of scientific research for the material and mental advance of the nation. History shows that each new discovery in geography or pure science produces a very subtle effect on the life of a people.

When, four hundred years before our era, Pythias led the Greeks for the first time through the pillars of Hercules and explored the shores of Britain, the new ideas concerning the outer ocean which he brought back produced a great impression on the Greek mind. An impetus was given to the study of terrestrial problems which culminated in the foundation of a scientific geography and the geographical works of Ptolemy. Ptolemy's Geography lay buried beneath the ruins of the ancient civilisation for a thousand years. Its reappearance, with its clearly drawn maps, produced a profound effect in Western Europe in the

middle of the fifteenth century, and led indirectly to the discovery of America. The discovery of America, the rounding of the Cape of Good Hope, and the circumnavigation of the world took place within a period of thirty years. It is impossible to exaggerate the impulse these great events gave to the human mind. The Renaissance and all the marvellous progress in science and civilisation during the past four hundred years may be regarded as largely the direct outcome of these voyages of exploration and the new ideas to which they gave birth. The discovery of the law of gravitation, of the circulation of the blood, of oxygen, each in its turn led in material and intellectual progress to stupendous results. By such inventions as the telescope and the microscope man's senses were indefinitely enlarged, and new occupations were created in many departments of science and industry.

In our own day people have become so accustomed to scientific discoveries following one another in an uninterrupted stream that many minds become deadened to their real import, and the conditions under which further advances can be made are not readily grasped. In many departments of science, investigations cannot now be carried on without expensive apparatus and complicated machines, which are mostly beyond the reach of private individuals. For this reason, if for no other, Antarctic and deep-sea exploration should be undertaken by the Government and the British Navy. There will always be differences of opinion as to how the surplus wealth of a nation should be applied, but it at all events seems certain that those nations which are spending the largest amount of their wealth and energy in seeking and finding out—in the making of knowledge—are destined in the future to occupy the foremost place in the world's affairs.

The naturalist, when studying the succession of life on the surface of our planet, sees how often thickness of hide, strength of jaw, sharpness of claw, and mass of muscle have had to give way in the struggle before a slight modification

in brain structure with its accompanying mental cuteness. And similarly, we may feel assured that ironclads and battlements will prove of little avail before an enemy, should there not be behind these bulwarks many inquisitive and inventive minds. This has received most abundant illustration in recent warfare. In what way can acute and fertile minds be more effectively produced than in the cultivation of that mental attitude which results in the accumulation of new knowledge, as distinguished from the dissemination among the people of knowledge already acquired?

The refusal of the British Government to undertake or to assist in Antarctic exploration is not likely to be modified, as has been suggested, by the Czar's proposal with reference to "a possible reduction of the excessive armaments which weigh upon all nations." It is, therefore, necessary to turn towards private enterprise and liberality, which have already done such great things in our land. What is wanted is that some rich man, or some rich men, should place in the hands of the President of the Royal Society at least £100,000 for the purpose of organising an Antarctic expedition to co-operate with the other expeditions that are preparing to set out in the year 1900. In the Antarctic regions lies the only great piece of geographical exploration still to be accomplished on the globe. This is a splendid opportunity for wealth to confer a lasting benefit on British science and to assist in the general development of knowledge. If we take no adequate part in this work, it will, notwithstanding our great material prosperity, be a sure indication that the younger progressive nationalities have suddenly risen to a higher intellectual plane than that on which we are proceeding.

A small Belgian expedition proceeded to the Antarctic last year, but as yet we have no encouraging news as to its progress. Another small Antarctic expedition has this year been fitted out by a patriotic Englishman. Although these expeditions are not furnished with the necessary apparatus for maritime exploration in accordance with modern ideas,

still they may result in many valuable and important additions to knowledge.

Modern science demands not so much a dash at the South Pole as a steady, continuous, laborious, hydrographic and topographical examination of the whole south polar area during several successive years. Such an examination would enrich almost every branch of science and would undoubtedly mark a great advance in the philosophy of terrestrial physics. I have long advocated the exploration of the Antarctic regions in this sense. It is true that this advocacy has been all in vain so far as this country is concerned, but it is not without interest to be told that it has produced some effect in other countries. The world is not going to stand still. The scientific exploration of the Antarctic will certainly take place in the near future. What really concerns us at the present moment is—Shall we stand aside while other countries carry through a great work in which it is the manifest duty of Great Britain to play a leading part, not only because of her wealth and position, but because of the indirect effect of such maritime and other explorations on the intellectual advance of her own citizens?

JOHN MURRAY.

THE SCIENTIFIC ADVANTAGES OF AN ANTARCTIC EXPEDITION.[1]

By Sir JOHN MURRAY, K.C.B., D.Sc., LL.D., Ph.D., F.R.S.

FROM a scientific point of view the advantages to be derived from a well-equipped and well-directed expedition to the Antarctic would, at the present time, be manifold. Every department of natural knowledge would be enriched by systematic observations as to the order in which phenomena coexist and follow each other in regions of the earth's surface about which we know very little or are wholly ignorant. It is one of the great objects of science to collect observations of the kind here indicated, and it may be safely said that without them we can never arrive at a right understanding of the phenomena by which we are surrounded, even in the habitable parts of the globe.

Before considering the various orders of phenomena, concerning which fuller information is urgently desired, it may be well to point out a fundamental topographical difference between the Arctic and Antarctic. In the northern hemisphere there is a polar sea almost completely surrounded by continental land, and continental conditions for the most part prevail. In the southern hemisphere, on the other hand, there is almost certainly a continent at the South Pole, which is completely surrounded by the ocean, and, in those latitudes, the most simple and extended oceanic conditions on the surface of the globe are encountered.

THE ATMOSPHERE.

One of the most remarkable features in the meteorology of the globe is the low atmospheric pressure at all seasons in the southern hemisphere south of latitude 45° S., with the accompanying strong westerly and north-westerly winds, large rain- and snow-fall, all round the South Polar regions. The mean pressure seems to be less than 29 inches, which is much lower than in similar latitudes in the northern hemisphere. Some meteorologists hold that this vast cyclonic system and low-pressure area continues south as far as the pole, the more southerly parts being traversed by secondary cyclones. There are, however, many indications that the extreme South Polar area is occupied by a vast anticyclone, out of which winds blow towards the girdle of low pressure outside the ice-bound region. In support of this view it is pointed out that Ross's barometric observations indicate a gradual rise in the pressure south of the latitude of 75° S., and all Antarctic voyagers agree that when near the ice the majority of the winds are from the south and south-east, and bring clear weather with fall of temperature, while northerly winds bring thick fogs with rise of temperature.

All our knowledge of the meteorological conditions of the Antarctic

[1] Reprinted by permission from the *Proceedings of the Royal Society*, vol. lxii.

is limited to a few observations during the midsummer months, and these indicate that the temperature of the snow-covered Antarctic continent is even at that time much lower than that of the surrounding sea. The anticyclonic area at the South Pole appears therefore to be permanent, and when in winter the sea-ice is for the most part continuous and extends far to the north, the anticyclonic area has most probably a much wider extension than in summer. This is indicated by the south-easterly winds which at times blow towards the southern point of the American continent in June and July.

All observations in high southern latitudes indicate an extremely low summer temperature. In winter we have no direct observations. The mean of Ross's air temperature south of latitude 63° S. was 28·74° F., which is about the freezing point of sea-water, and his maximum temperature was 43·5° F. Both Wilkes and D'Urville observed pools of fresh water on several icebergs, and, when sailing along the ice barrier, Ross saw "gigantic icicles depending from every projecting point of its perpendicular cliffs,"[1] so it is probable that extensive melting sometimes takes place.

In the latitude of the Antarctic circle the air is frequently at or near the point of saturation, and precipitation takes place in the form of rain, sleet, snow, or hail. Most of the observations near the ice-covered land show, however, a much drier atmosphere, and in all probability precipitation over the Antarctic continent takes place in the form of fine snow crystals, such as is recorded in the interior of Greenland.

There would appear, then, to be good reasons for believing that the region of the South Pole is covered by what may be regarded practically as a great permanent anticyclone, with a much wider extension in winter than in summer. It is most likely that the prevailing winds blow out from the pole all the year round towards the surrounding sea, as in the case of Greenland, but, unlike Greenland, this area is probably seldom traversed by cyclonic disturbances.

But what has been stated only shows how little real knowledge we possess concerning the atmospheric conditions of high southern latitudes. It is certain, however, that even two years' systematic observations within these regions would be of the utmost value for the future of meteorological science.

Antarctic Ice.

From many points of view it would be important to learn something about the condition and distribution of Antarctic sea-ice during the winter months, and especially about the position and motions of the huge table-shaped icebergs at this and other seasons of the year. These flat-topped icebergs, with a thickness of 1200 or 1500 feet, with their stratification and their perpendicular cliffs, which rise 150 or 200 feet above and sink 1100 or 1400 feet below the level of the sea, form the most striking peculiarity of the Antarctic Ocean. Their form

[1] Ross, *Antarctic Voyage*, vol. i. p. 237.

and structure seem clearly to indicate that they were formed on an extended land surface, and have been pushed out over low-lying coasts into the sea.

Ross sailed for 300 miles along the face of a great ice-barrier from 150 to 200 feet in height, off which he obtained depths of 1800 and 2400 feet. This was evidently the sea-front of a great creeping glacier or ice-cap just then in the condition to give birth to the table-shaped icebergs, miles in length, which have been described by every Antarctic voyager.

All Antarctic land is not, however, surrounded by such inaccessible cliffs of ice, for along the seaward faces of the great mountain ranges of Victoria Land the ice and snow which descend to the sea apparently form cliffs not higher than 10 to 20 feet, and in 1895 Kristensen and Borchgrevink landed at Cape Adare on a pebbly beach, occupied by a penguin rookery, without encountering any land-ice descending to the sea. Where a penguin rookery is situated, we may be quite sure that there is occasionally open water for a considerable portion of the year, and that consequently landing might be effected without much difficulty or delay, and further that a party, once landed, might with safety winter at such a spot, where the penguins would furnish an abundant supply of food and fuel. A properly equipped party of observers situated at a point like this on the Antarctic continent for one or two winters might carry out a most valuable series of scientific observations, make successful excursions towards the interior, and bring back valuable information as to the probable thickness of the ice-cap, its temperature at different levels, its rate of accumulation, and its motions, concerning all which points there is much difference of opinion among scientific men.

Antarctic Land.

Is there an Antarctic continent? It has already been stated that the form and structure of the Antarctic icebergs indicate that they were built up on, and have flowed over, an extended land surface. As these bergs are floated to the north and broken up in warmer latitudes they distribute over the floor of the ocean a large quantity of glaciated rock fragments and land detritus. These materials were dredged up by the *Challenger* in considerable quantity, and they show that the rocks over which the Antarctic land-ice moved were gneisses, granites, mica-schists, quartziferous diorites, grained quartzites, sandstones, limestones, and shales. These lithological types are distinctively indicative of continental land, and there can be no doubt about their having been transported from land situated towards the South Pole. D'Urville describes rocky islets off Adélie Land composed of granite and gneiss. Wilkes found on an iceberg, near the same place, boulders of red sandstone and basalt. Borchgrevink and Bull have brought back fragments of mica-schists and other continental rocks from Cape Adare. Dr. Donald brought back from Joinville Island a piece of red jasper or chert containing Radiolaria and Sponge spicules. Captain Larsen brought from

is limited to a few observations during the midsummer months, and these indicate that the temperature of the snow-covered Antarctic continent is even at that time much lower than that of the surrounding sea. The anticyclonic area at the South Pole appears therefore to be permanent, and when in winter the sea-ice is for the most part continuous and extends far to the north, the anticyclonic area has most probably a much wider extension than in summer. This is indicated by the south-easterly winds which at times blow towards the southern point of the American continent in June and July.

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Seymour Island pieces of fossil coniferous wood, and also fossil shells of *Cucullæa*, *Cytherea*, *Cyprina*, *Teredo*, and *Natica*, having a close resemblance to species known to occur in lower Tertiary beds in Britain and Patagonia. These fossil remains indicate in these areas a much warmer climate in past times. We are thus in possession of abundant indications that there is a wide extent of continental land within the ice-bound regions of the southern hemisphere.

It is not likely that any living land-fauna will be discovered on the Antarctic continent away from the penguin rookeries. Still, an Antarctic expedition will certainly throw much light on many geological problems. Fossil finds in high latitudes are always of special importance. The pieces of fossil wood from Seymour Island can hardly be the only relics of plant life that are likely to be met with in Tertiary and even older systems within the Antarctic. Tertiary, Mesozoic, and Palæozoic forms are tolerably well developed in the Arctic regions, and the occurrence of like forms in the Antarctic regions might be expected to suggest much as to former geographical changes, such as the extension of Antarctica towards the north, and its connection with, or isolation from, the northern continents, and also as to former climatic changes, such as the presence in pre-Tertiary times of a uniform temperature in the waters of the ocean all over the surface of the globe.

Magnetic and Pendulum Observations, Geodetic Measurements, Tides, and Currents.

In any Antarctic expedition magnetic observations would, of course, form an essential part of the work to be undertaken, and the importance of such observations has been frequently dwelt upon by eminent physicists and navigators. Should a party of competent observers be stationed at Cape Adare for two years, pendulum observations could be carried out there and at other points within the Antarctic, or even on the ice-cap and icebergs. It might be possible to measure a degree on the Antarctic continent or ice-cap, which would be a most useful thing to do. By watching the motions of the icebergs and ice from land at Cape Adare much would be learned about oceanic currents, and our knowledge of the tides would be increased by a systematic series of tidal observations on the shores of the Antarctic continent, where we have at present no observations. The series of scientific observations here mentioned, and others that might be indicated, would fill up many gaps in our knowledge of the physical conditions of these high southern latitudes.

Depth of the Antarctic Ocean.

In regard to the depth of the ocean immediately surrounding the Antarctic continent we have at present very meagre information, and one of the objects of an Antarctic expedition would be to supplement our knowledge by an extensive series of soundings in all directions throughout the Antarctic and Southern Oceans. It would in this way be possible, after a careful consideration of the depths and marine

deposits, to trace out approximately the outlines of the Antarctic continent. At the present time we know that Ross obtained depths of 100 to 500 fathoms all over the great bank extending to the east of Victoria Land, and somewhat similar depths have been obtained extending for some distance to the east of Joinville Island. Wilkes sounded in depths of 500 and 800 fathoms about 20 or 30 miles off Adélie Land. The depths found by the *Challenger* in the neighbourhood of the Antarctic circle were from 1300 to 1800 fathoms, and farther north the *Challenger* soundings ranged from 1260 to 2600 fathoms. To the south-west of South Georgia, Ross paid out 4000 fathoms of line without reaching bottom. In the charts of depth which I have constructed I have always placed a deep sea in this position, for it appears to me that Ross, who knew very well how to take soundings, was not likely to have been mistaken in work of this kind.

The few indications which we thus possess of the depth of the ocean in this part of the world seem to show that there is a gradual shoaling of the ocean from very deep water towards the Antarctic continent, and, so far as we yet know, either from soundings or temperature observations, there are no basins cut off from general oceanic circulation by barriers or ridges, similar to those found towards the Arctic.

Deposits of the Antarctic Ocean.

The deposits which have been obtained close to the Antarctic continent consist of blue mud, containing glauconite, made up for the most part of detrital matters brought down from the land, but containing a considerable admixture of the remains of pelagic and other organisms. Farther to the north there is a very pure diatom ooze, containing a considerable quantity of detrital matter from icebergs, and a few pelagic foraminifera. This deposit appears to form a zone right round the earth in these latitudes. Still farther to the north the deposits pass in deep water, either into a Globigerina ooze, or into a red clay with manganese nodules, sharks' teeth, ear-bones of whales, and the other materials characteristic of that deep-sea deposit. Since these views, however, as to the distribution of deep-sea deposits throughout these high southern latitudes, are founded upon relatively few samples, it cannot be doubted that further samples from different depths in the unexplored regions would yield most interesting information.

Temperature of the Antarctic Ocean.

The mean daily temperature of the surface waters of the Antarctic, as recorded by Ross, to the south of latitude 63° S. in the summer months, varies from 27·3° to 33·6°, and the mean of all his observations is 29·85°. As already stated, his mean for the air during the same period is somewhat lower, being 28·74°. In fact, all observations seem to show that the surface water is warmer than the air during the summer months.

The *Challenger* observations of temperature beneath the surface

indicate the presence of a stratum of colder water wedged between warmer water at the surface, and warm water at the bottom. This wedge-shaped stratum of cold water extends through about 12° of latitude, the thin end terminating about latitude 53° S., its temperature varying from 28° at the southern thick end to 32·5° at the northern thin end, while the temperature of the overlying water ranges from 29° in the south to 38° in the north, and that of the underlying water from 32° to 35°. This must be regarded as the distribution of temperature only during the summer, for it is improbable that during the winter months there is a warmer surface layer.

In the greater depths of the Antarctic, as far south as the Antarctic circle, the temperature of the water varies between 32° and 35° F., and is not, therefore, very different from the temperature of the deepest bottom water of the tropical regions of the ocean. The presence of this relatively warm water in the deeper parts of the Antarctic Ocean may be explained by a consideration of general oceanic circulation. The warm tropical waters which are driven southwards along the eastern coasts of South America, Africa, and Australia, into the great all-encircling Southern Ocean, there become cooled as they are driven to the east by the strong westerly winds. These waters, on account of their high salinity, can suffer much dilution with Antarctic water, and still be denser than water from these higher latitudes at the same temperature. Here the density observations and the sea-water gases indicate that the cold water found at the greater depths of the ocean probably leaves the surface and sinks towards the bottom in the Southern Ocean, between the latitudes of 45° and 56° S. These deeper, but not necessarily bottom, layers are then drawn slowly northwards towards the tropics, to supply the deficiencies there produced by evaporation and southward-flowing surface currents, and these deeper layers of relatively warm water appear likewise to be slowly drawn southwards to the Antarctic area to supply the place of the ice-cold currents of surface water drifted to the north. This warm underlying water is evidently a potent factor in the melting and destruction of the huge table-topped icebergs of the southern hemisphere. While these views as to circulation appear to be well established, still a fuller examination of these waters is most desirable at different seasons of the year, with improved thermometers and sounding machines. Indeed, all deep-sea apparatus has been so much improved as a result of the *Challenger* explorations, that the labour of taking specific gravity and all other oceanographical observations has been very much lessened.

Pelagic Life of the Antarctic Ocean.

In the surface waters of the Antarctic there is a great abundance of diatoms and other marine algæ. These floating banks or meadows form primarily not only the food of pelagic animals, but also the food of the abundant deep-sea life which covers the floor of the ocean in these south polar regions. Pelagic animals, such as copepods, amphipods, molluscs, and other marine organisms, are also very abundant, although species

are fewer than in tropical waters. Some of these animals seem to be nearly, if not quite, identical with those found in high northern latitudes, and they have not been met with in the intervening tropical zones. The numerous species of shelled Pteropods, Foraminifera, Coccoliths and Rhabdoliths, which exist in the tropical surface waters, gradually disappear as we approach the Antarctic circle, where the shelled Pteropods are represented by a small *Limacina*, and the Foraminifera by only two species of *Globigerina*, which are apparently identical with those in the Arctic Ocean. A peculiarity of the tow-net gatherings made by the *Challenger* Expedition in high southern latitudes, is the great rarity or absence of the pelagic larvæ of benthonic organisms, and in this respect they agree with similar collections from the cold waters of the Arctic seas. The absence of these larvæ from polar waters may be accounted for by the mode of development of benthonic organisms, to be referred to presently. It must be remembered that many of these pelagic organisms pass most of their lives in water of a temperature below 32° F., and it would be most interesting to learn more about their reproduction and general life-history.

Benthos Life of the Antarctic Ocean.

At present we have no information as to the shallow-water fauna of the Antarctic continent; but, judging from what we do know of the off-lying Antarctic islands, there are relatively few species in the shallow waters in depths less than 25 fathoms. On the other hand, life in the deeper waters appears to be exceptionally abundant. The total number of species of Metazoa collected by the *Challenger* at Kerguelen in depths less than 50 fathoms was about 130, and the number of additional species known from other sources from the shallow waters of the same island is 112, making altogether 242 species, or thirty species less than the number obtained in eight deep hauls with the trawl and dredge in the Kerguelen region of the Southern Ocean, in depths exceeding 1260 fathoms, in which eight hauls 272 species were obtained. Observations in other regions of the Great Southern Ocean, where there is a low mean annual temperature, also show that the marine fauna around the land in high southern latitudes appears to be very poor in species down to a depth of 25 fathoms, when compared with the number of species present at the mud-line about 100 fathoms, or even at depths of about two miles.

In the year 1841 Sir James Clark Ross dredged off the Antarctic continent species which he recognised as the same as he had been in the habit of taking in equally high northern latitudes, and he suggested that they might have passed from the one pole to the other by way of the cold water of the deep sea. Subsequent researches show that, as with pelagic organisms, many of the bottom-living species are identical with, or closely allied to, those of the Arctic regions, and are not represented in the intermediate tropical areas. For instance, the most striking character of the shore-fish fauna of the Southern Ocean is the reappearance of types inhabiting the corresponding latitudes of the northern

hemisphere, and not found in the intervening tropical zone. This interruption of continuity in the distribution of shore-fishes is exemplified by species as well as genera, and Dr. Günther enumerates eleven species and twenty-nine genera as illustrating this method of distribution.

The following are the eleven species:—*Chimæra monstrosa*, *Galeus canis*, *Acanthias vulgaris*, *Acanthias Blainvilli*, *Rhina squatina*, *Zeus faber*, *Lophius piscatorius*, *Centriscus scolopax*, *Engraulis encrasicholus*, *Clupea sprattus*, *Conger vulgaris*.

The genus by which the family Berycidæ is represented in the southern temperate zone (*Trachichthys*) is much more nearly allied to the northern than to the tropical genera. "As in the northern temperate zone, so in the southern . . . the variety of forms is much less than between the tropics. This is especially apparent on comparing the number of species constituting a genus. In this zone, genera composed of more than ten species are the exception, the majority having only from one to five." . . . "*Polyprion* is one of those extraordinary instances in which a very specialised form occurs at almost opposite points of the globe, without having left a trace of its previous existence in, or of its passage through, the intermediate space."

Speaking of the shore-fishes of the Antarctic Ocean, Günther says: "The general character of the fauna of Magelhaen's Straits and Kerguelen's Land is extremely similar to Iceland and Greenland. As in the Arctic fauna, Chondropterygians are scarce, and represented by *Acanthias vulgaris* and species of *Raja* . . . As to Acanthopterygians, Cataphracti and Scorpænidæ are represented as in the Arctic fauna, two of the genera (*Sebastes* and *Agonus*) being identical. The Cottidæ are replaced by six genera of Trachinidæ, remarkably similar in form to Arctic types . . . Gadoid fishes reappear, but are less developed; as usual they are accompanied by *Myxine*. The reappearance of so specialised a genus as *Lycodes* is most remarkable."[1]

These statements with reference to shore-fishes might, with some modifications, be repeated concerning the distribution and character of all classes of marine invertebrates in high northern and high southern latitudes.[2] The *Challenger* researches show that nearly 250 species taken in high southern latitudes occur also in the northern hemisphere, but are not recorded from the tropical zone. Fifty-four species of

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[1] Günther, *Study of Fishes*, pp. 282-290. Edinburgh, 1880.

[2] Ortmann, speaking of the Decapod Crustacea, says: "Nach dem Stande unser er jetzigen Kenntniss ist *keine einzige bipolare Art bekannt*" (Ortmann, *Zoologische Jahrbücher*, Abth. f. Syst., etc., Bd. ix. p. 585, 1896). Henderson, in his report on the *Challenger* Anomura, in describing *Lithodes murrayi* from the Kerguelen region, says it "is apparently most closely allied to *Lithodes maia*" (from the North Atlantic), "but the latter species is of large size, and the spines on the carapace are more numerous and more uniformly equal in size" (Henderson, *Zool. Chall. Exp.*, pt. 69, p. 44). Henderson writes me that these very slight differences were the only ones he could detect, and it seems evident that had the two specimens been taken from the same haul of the trawl, or from the same locality, they would never have been erected into two distinct species. Henderson writes me further that throughout the entire range of Crustacea there is no better illustration of bipolarity than that furnished by the Lithodidæ. For instances of new species being made from purely geographical considerations, see *Summary of Results*, "*Challenger*" *Expedition*, pp. 1440-45.

seaweeds have also been recorded as showing a similar distribution.[1] Bipolarity in the distribution of marine organisms is a fact, however much naturalists may differ as to its extent and the way in which it has originated.

All those animals which secrete large quantities of carbonate of lime greatly predominate in the tropics, such as Corals, Decapod Crustacea, Lamellibranchs, and Gasteropods. On the other hand, those animals in which there is a feeble development of carbonate of lime structures predominate in cold polar waters, such as Hydroida, Holothurioidea, Annelida, Amphipoda, Isopoda, and Tunicata. This difference is in direct relation with the temperature of the water in which these organisms live, a much more rapid and abundant precipitate of carbonate of lime being thrown down in warm than in cold water by ammonium carbonate, one of the waste products of organic activity.

In the Southern and Sub-antarctic Ocean a large proportion of the Echinoderms develop their young after a fashion which precludes the possibility of a pelagic larval stage. The young are reared within or upon the body of the parent, and have a kind of commensal connection with her till they are large enough to take care of themselves. A similar method of direct development has been observed in eight or nine species of Echinoderms from the cold waters of the northern hemisphere. On the other hand, in temperate and tropical regions the development of a free-swimming larva is so entirely the rule that it is usually described as the normal habit of the Echinodermata. This similarity in the mode of development between Arctic and Antarctic Echinoderms (and the contrast to what takes place in the tropics) holds good also in other classes of Invertebrates, and probably accounts for the absence of free-swimming larvæ of benthonic animals in the surface gatherings in Arctic and Antarctic waters.

What is urgently required with reference to the biological problems here indicated is a fuller knowledge of the facts, and it cannot be doubted that an Antarctic expedition would bring back collections and observations of the greatest interest to all naturalists and physiologists, and without such information it is impossible to discuss with success the present distribution of organisms over the surface of the globe, or to form a true conception of the antecedent conditions by which that distribution has been brought about.

Concluding Remarks.

There are many directions in which an Antarctic Expedition would carry out important observations besides those already touched on in the foregoing statement. From the purely exploratory point of view much might be urged in favour of an Antarctic Expedition at an early date; for the further progress of scientific geography it is essential to have a more exact knowledge of the topography of the Antarctic regions. This would enable a more just conception of the volume relations of land and

[1] Murray and Barton, *Phycological Memoirs of the British Museum*, part iii. London, 1895.

sea to be formed, and in connection with pendulum observations some hints as to the density of the sub-oceanic crust and the depth of ice and snow on the Antarctic continent might be obtained. In case the above sketch may possibly have created the impression that we really know a great deal about the Antarctic regions, it is necessary to restate that all the general conclusions that have been indicated are largely hypothetical, and to again urge the necessity for a wider and more solid base for generalisations. The results of a successful Antarctic Expedition would mark a great advance in the philosophy—apart from the mere facts—of terrestrial science.

No thinking person doubts that the Antarctic will be explored. The only questions are: when? and by whom? I should like to see the work undertaken at once, and by the British Navy. I should like to see a sum of £150,000 inserted in the Estimates for the purpose. The Government may have sufficient grounds for declining to send forth such an expedition at the present time, but that is no reason why the scientific men of the country should not urge that the exploration of the Antarctic would lead to important additions to knowledge, and that, in the interests of science among English-speaking peoples, the United Kingdom should take not only a large but a leading part in any such exploration.

Remarks by the Duke of Argyll.

Scientific men generally feel, I think, that they do not need to give detailed reasons in connection with particular subjects of inquiry, to justify their unanimous desire for an Antarctic Expedition. It is enough, surely, for them to point out the fact that a very large area of the surface of our small planet is still almost unknown to us. That it should be so seems almost a reproach to our civilisation. As to detailed reasons, it may almost be said with truth that there is hardly one of the physical sciences on which important light may not be cast by Antarctic exploration. Oceanic circulation; meteorology; magnetism; distribution of animal and vegetable life, not only in the present but in the past; geology; mineralogy; volcanic action under special conditions—all of these are subjects on which the phenomena of the Antarctic regions are sure to bear directly.

If, however, I am asked to specify more particularly the question on which I look for invaluable evidence which can be got nowhere else, I must name, above all others, the most difficult questions involved in Quaternary geology. Geologists are nearly all agreed that there has been, very recently, a glacial age—an age in which glacial conditions prevailed over the whole northern hemisphere to a much lower latitude than they prevail now. But geologists differ widely and fundamentally from each other as to the form which glacial agencies took during that period. In particular, many geologists believe in what they call an "ice-sheet"—that is to say, in the northern world having been covered by an

enormous mass of ice several thousand feet thick, which, as they assert, "flowed" over mountain areas as well as over plains, and filled up the bed of seas of a considerable depth. Other geologists disbelieve in this agency altogether. They deny that, even if such a body of ice ever existed, it could possibly have moved in the way which the theory assumes. They affirm, also, that the facts connected with glaciated surfaces do not indicate the planing down by one universal sheet of enormous weight and pressure; but, on the contrary, the action of small and lighter bodies of ice, which have acted partially and unequally on different surfaces differently exposed.

We might have hoped that this controversy could be settled by the facts connected with the only enormous ice-sheet which exists in the Northern Hemisphere, viz., that which covers the great continent of Greenland. But that ice-sheet, enormous though it be, does certainly not do what the ice-sheet of the Glacial Age is supposed to have done. That is to say, it does not flow out from Greenland, fill the adjacent seas, or override the opposite coasts, even in so narrow a strait as Smith's Sound. But this evidence is negative only. In the Antarctic continent we have reason to believe that there is a larger ice-sheet, and it certainly does protrude into the adjacent seas, not merely by sending out vast floating fragments, but in unbroken ice-cliffs of great height. Now we want to know exactly under what conditions this protrusion takes place. Dr. Murray speaks of it as "creeping" seawards—a more cautious word than "flowing." But is it certain that it does even creep? May it not simply grow by accretion or aggregation till it reaches a depth of water so great as to break it off by floatation? Does it, or does it not, carry detritus when no detritus has been dropped on its surface? Or does it pick up detritus from its own bed? Or does it push foreign matter before it? Is the perfectly tabular form of the Antarctic icebergs compatible with any differential movement in the parent mass at all; or does it not indicate, on the contrary, a condition of immobility until their buoyancy lifts great fragments off? What is the condition of the rocks on which they rest? Is there any thrust upon the mass from the mountain ranges on which the gathering-ground lies? Or is the whole country one vast gathering-ground from the continual excess of precipitation over melting? These questions, and a hundred others, have to be solved by Antarctic discovery; and until they are solved we cannot argue with security on the geological history of our own now temperate regions. The Antarctic continent is unquestionably the region of the earth in which glacial conditions are at their maximum, and therefore it is the region in which we must look for all the information attainable towards, perhaps, the most difficult problem with which geological science has to deal.

Remarks by Sir J. D. Hooker.

Dr. Murray's admirable summary of the scientific information obtainable by an organised exploration of the Antarctic regions leaves nothing further to be said under that head. I can only record the satisfaction

with which I heard it, and my earnest hope that it will lead to action being taken by the Government in the direction indicated.

Next to a consideration of the number and complexity of the objects to be attained by an Antarctic expedition, what dwells most in my imagination is the vast area of the unknown region which is to be the field for investigation—a region which in its full extension reaches from the latitude of 60° S. to the Southern Pole, and embraces every degree of longitude. This is a very considerable portion of the surface of the globe, and it is one that has been considered to be for the most part inaccessible to man. I will therefore ask you to accompany the scientific explorer no further than to the threshold of the scenes of his labours, that you may see how soon and how urgently he is called upon to study some of those hitherto unsolved Antarctic problems that he will there encounter.

In latitude 60° S. an open ocean girdles the globe without break of continuity. Proceeding southwards in it, probably before reaching the Antarctic circle, he encounters the floating ice-fields which form a circumpolar girdle, known as "the Pack," approximately concentric with the oceanic, interrupted in one meridian only, that south of Cape Horn, by the northern prolongation of Graham's Land. Pursuing his southward course in search of seas or lands beyond, after the novelty of his position in the pack has worn off, he asks where and how the components of these great fields of ice had their origin? how they arrived at and maintain their present position? what are their rate of progress and courses? and what their influence on the surrounding atmosphere and ocean? I believe I am right in thinking that to none of these questions can a fuller answer be given than that they originated over extensive areas of open water in a higher latitude than they now occupy, that they are formed of frozen ocean water and snow, and that winds and currents have brought them to where we now find them. But of the position of the southern open waters, with the exception of the comparatively small area east of Victoria Land,[1] we know nothing, nor do we know anything of the relative amount of snow and ice of which they are composed, or of their age, or of the winds and currents that have carried them to a lower latitude.

The other great glacial feature of the Antarctic area is "the Barrier," which Ross traced for 300 miles, in the 78th and 79th degrees of south latitude, maintaining throughout the character of an inaccessible precipitous ice-cliff (the sea-front of a gigantic glacier) of 150 to 200 feet in height. This stupendous glacier is no doubt one parent of the huge table-topped ice-islands that infest the higher latitudes of the Southern Ocean; but, as in the case of the pack ice, we do not know where the barrier has its origin, or anything further about it, than that it in great part rests on

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[1] I refer to the "pancake" ice, which in that area on several occasions formed with great rapidity around Ross's ships, lat. 76° to 78° S., in February 1842, and which arrested their progress. Such ice, augmented by further freezing of the water and by snow, may be regarded as the genesis of fields that, when broken up by gales, are carried to the north and contribute to the circumpolar pack.

the bottom of a comparatively shallow ocean. It probably abuts upon land, possibly upon an Antarctic continent; but to prove this was impossible on the occasion of Ross's visit, for the height of the crow's-nest above the surface of the sea was not sufficient to enable him to overlook the upper surface of the ice, nor do I see any other way of settling this important point except by the use of a captive balloon—an appliance with which I hope any future expedition to the Antarctic regions will be supplied. There were several occasions on which such an implement might have been advantageously used by Ross when he was coasting along the barrier; and there were more when it would have greatly facilitated his navigation in the Pack.

I have chosen the subject of the Antarctic ice as the theme for my acknowledgment of the honour you have done me in asking me to address this most important meeting, not only because it is one of the very first of the phenomena that demand the study of the explorer, but because it is the dominant feature in Antarctic navigation, where the ice is ever present, demanding, whether for being penetrated or evaded, all the commander's fortitude and skill and all his crew's endurance.

It may be expected that I should allude to those sections of Dr. Murray's summary that refer to the Antarctic fauna and flora. They are most important, for the South Polar Ocean swarms with animal and vegetable life. Large collections of these, taken both by the tow-net and by deep-sea soundings, were made by Sir J. Ross, who was an ardent naturalist, and threw away no opportunity of observing and preserving; but unfortunately, with the exception of the *Diatomaceæ* (which were investigated by Ehrenberg), very few of the results of his labour in this direction have been published. A better fate, I trust, awaits the treasures that the hoped-for expedition will bring back, for so prolific is that ocean that the naturalist need never be idle, no, not even for one of the twenty-four hours of daylight during the whole Antarctic summer, and I look to the results of a comparison of the oceanic life of the Arctic and Antarctic regions as the heralding of an epoch in the history of biology.

Remarks by Dr. G. Neumayer.

With great pleasure I accepted the invitation to attend a discussion meeting on the importance, for the advancement of every branch of science, of a scientific exploration of the Antarctic region. Regardless of the season and my advanced age, I hastened here to speak, in the presence of so high a forum as the Royal Society of London, on the necessity of despatching as soon as possible an expedition towards the South Pole—an expedition cannot be dispensed with if we seriously desire the advancement of nearly every branch of human knowledge. It is fifty-five years ago since one of the greatest Arctic and Antarctic explorers ceased his work, so exceedingly well executed, in the Antarctic regions, and, since that time, it has never been taken up in any way comparable with that glorious scientific and nautical spirit manifested by Sir James Clark Ross. It is in view of this fact that we all look to the British nation as the one

destined to carry on the exploration of the South Polar regions, and to assist this object as much as lay in my power, and to do homage to the memory of Ross, I could not fail to appear at this meeting.

It is indeed a matter of great interest to examine the reason why so long a time has been allowed to elapse since the first great successes in the middle of this century. Undoubtedly political questions have interfered in an unusual manner so to retard progress in Antarctic inquiry, but it is not that alone; the cause is mainly that the thorough understanding of the importance of Antarctic research requires an unusual amount of knowledge, and not in one branch of science only, but in the whole complex of natural philosophy and natural science. The positive advantages to be derived from a renewal of Antarctic exploration appear but few at first glance, and can only be detected by a far-sighted man. The Royal Geographical Society has taken up the agitation for that renewal. The Sixth International Geographical Congress, two and a half years ago, devoted its influential exertions to the recommendation of it to the Government, not only of this country, but, indeed, of all civilised countries. But now that the Royal Society has taken the matter up (an example which will be followed, I am convinced, by other academies of science), final success may be looked upon as matter of certainty.

However much has been done already to urge the importance of the scientific investigation of the South Polar regions, from as many points of view as there are branches of science cultivated by mankind, I consider it my duty, as a representative of geophysical science, to add all the arguments in my power to those brought forward on the part of geologists, zoologists, botanists, and others.

A gravitation survey in connection with a thorough geographical exploration of the Antarctic is one of the most urgent requirements of the science of our earth. There are no measurements of the gravitation constant within the Antarctic region; indeed they are very scarce in the southern hemisphere south of 30° south latitude. Such measurements are so closely connected with the theory of the figure of our earth, that it may well be asked how it can be considered possible to achieve any advance in this respect, to arrive at any conclusive results in this all-important fundamental matter, without observations within the Antarctic region. It is impossible to foretell what effect an exact gravitation survey in that region might exert upon our views with regard to all physical and terrestrial constants, which depend on the radius of our earth. Apart from that consideration, we may hope for another important enlargement of our knowledge bearing upon the connection between terrestrial magnetism and gravity. Gravity observations have been so much simplified of late by von Sterneck's ingenious apparatus, that there is no serious difficulty in so multiplying gravity determinations within the Antarctic region, that we shall be quite justified in speaking of a "gravitation survey." The all-important question of the distribution of land within the South Polar region is closely connected with it, and our leading authority on geodesy, Professor Helmert, justly lays great stress upon the observation of the force of gravity south of 60° south latitude. He induced the International Geodetic Permanent Commission

to express it as their conviction that a gravitation survey within that region would be of the greatest benefit for higher geodetic theory (October, 1895).

I have already alluded to the probable connection between gravity and terrestrial magnetism. But apart from that, a magnetic survey of the Antarctic region is of the greatest importance from other points of view. As, since the time of Ross, no fresh observations on the values of the magnetic elements have been made, we are entirely ignorant of the values of the secular variation south of 50° latitude, data so much needed for the construction of reliable magnetic charts. Of the situation of the southern magnetic pole, and of its motion during the last fifty years, we are equally ignorant. The situation of the southern extremity of the earth's magnetic axis and its motion throughout half a century are extremely important according to Gauss's theoretical deductions. All computations, however intricate, must prove incomplete, and inadequately reward the immense amount of labour bestowed upon them, unless reliable values of the magnetic elements are first obtained, for which purpose a reduction to a certain epoch by means of secular changes is indispensable. But not merely for theoretical purposes is such value to be put upon knowledge of a magnetic character in the Antarctic, but also for the construction of reliable magnetic charts for use in navigation. Certainly the studies of Carlheim-Gyllenskjöld and Van Bemmelen deserve great credit from a theoretical point of view, but they also cannot be carried to perfection unless we have a sound knowledge of the magnetic character of the South Polar region—at least as sound as that of the North Polar region. In the time of Ross, the magnetic Observatory at Hobart served as a safe basis for observations on terrestrial magnetism, and now the excellent Observatory at Melbourne may be turned to a similar account.

Well as the mathematical theory of terrestrial magnetism has been developed, of the physical theory of that mysterious natural force, we are as yet in perfect ignorance. This defect is certainly to some considerable degree caused by the deficiency of our knowledge in higher latitudes. It looks as if the magnetic character of the South Polar region were such as would afford every facility for a sound investigation when brought into comparison with the magnetic conditions of the North Polar region. A glance at the map shows how entirely different is the distribution of the magnetic force (action) in the two polar regions. In the south there is to be noticed the interesting fact that the two foci of total intensity are both situated on the side towards the south of the Australian continent, and nearly on the same meridian.

The magnetic action which makes itself manifest by magnetic storms or disturbances reaches its highest degree likewise south of the Australian continent, whereas to the south of South America these disturbances become very scarce and of a character in point of magnitude similar to those of the temperate zones. This was most strikingly proved by the observations in Orange Bay and South Georgia during the period of International Observations in 1882-83. Of course, the magnetic South Pole and the situation of the foci above mentioned are in close connec-

tion with these facts, but the reason for this distribution remains unexplained. In agreement with this is the relative frequency of the South Polar lights within one and the same epoch. The map here shows the results of a discussion of all observations on southern lights, and, as may be perceived at a glance, the conformity with the fact just mentioned with regard to the region of maximum disturbance is striking. It may be mentioned, also, that a discussion of the magnetic state of our earth for the epoch 1885 has yielded a curious fact (perhaps merely a coincidence), namely, that Dr. Schmidt, of Gotha, has calculated that part of the magnetic action of our earth which lies outside it, above the earth's atmosphere probably, and has arrived at the conclusion that this part amounts to about one-fiftieth part of the entire potential. The curves which he constructed, based on this calculation, show likewise a close coincidence with the frequency of the southern lights. This requires to be further investigated, for it is perhaps a mere coincidence. The question of atmospheric electricity, yet under the shadow of a hypothesis of more or less probability, may yield, in connection with the matters touched upon, some results more definite than science has hitherto been able to divine. Under all these circumstances we perceive that there are a number of problems yet to be solved, which must stimulate the scientific world to enter upon a close and conscientious examination of a region still enveloped in total darkness.

The necessity of climatological researches within the Antarctic region has already been so much urged that it does not appear necessary for me to enter upon the matter. That it must remain impossible to arrive at exact climatological constants, so long as we do not know the winter temperature in that large area round the South Pole and bounded by the South Polar circle, is evident to every one conversant with the subject and does not require any further illustration.

With regard to atmospheric pressure there is another curious fact which requires investigation, only to be carried on by observations within the Antarctic. The excess of barometric pressure in 35° latitude over that in 60° latitude amounts in the northern hemisphere to 19·0 mm. and in the southern hemisphere to only 3·7 mm. Here is another problem worthy of examination.

With the recital of these few facts, which suffice to prompt us to institute a vigorous examination of the South Polar regions, the series is far from being exhausted. There is the question of the geoid-deformation, the phenomena of the tides, the structure of the ice and its drifting, especially the interesting fact of the appearance of ice in lower southern latitudes, where it has never been observed since observations thereon are recorded.

The resolution of the Sixth International Congress of Geographers, assembled here in August 1895, according to which the present century ought not to be allowed to expire without the unveiling of the mysteries of the South Polar regions, ought to be carried into execution by sending out an expedition to that end. All scientific institutions and societies have a well-founded interest that such expedition should take place without further delay.

Remarks by Sir Clements Markham.

I need scarcely say how fully I concur in every word that has fallen from Dr. Murray on the subject of the scientific results, and more especially of the geographical results, of an Antarctic Expedition. It is quite sufficient to point out the vast extent of the unknown area, and that no area of like extent on the surface of the earth ever failed to yield results of practical as well as of purely scientific value by its exploration.

But there is much more to be said in the present instance, because the little that we do know of the Antarctic regions points unmistakably to the very great importance and interest of the results that are certain to attend further research. The ice-barrier discovered by Sir James Ross is known to be the source of the immense ice islands of the Southern Polar Sea. But it has only been seen for a distance of 300 miles. It requires far more complete examination before any approach to an adequate knowledge can be obtained respecting the extent and nature of the supposed ice-cap in its rear.

We know that the Southern Continent is a region of actual volcanic activity, but the extent, nature, and effects of that activity remain to be ascertained. On the Antarctic Circle land has been sighted at numerous points, but it is unknown whether what has been seen indicates small islands or a continuous coastline.

Dr. Murray has pointed out that the whole Southern Continent is certainly not bounded by such an ice-wall as was seen by Sir James Ross, and is not covered by an ice-cap. But the extent of the ice-cap and of the uncovered land is unknown. We are ignorant of the distribution of land and sea, and of ice and water in summer, and of the causes which influence such distribution.

The investigation of each one of these points, and of many others, will lead to further discoveries as yet undreamt of, which must needs be of the deepest interest to geographers. There are eminent scientific men present who will no doubt refer to the results of exploration in other branches of science. Combined together they make the exploration of the Antarctic regions the greatest and most important work that remains to be achieved by this generation.

Remarks by Dr. Alexander Buchan.

Dr. Alexander Buchan stated that his remarks would have exclusive reference to the first two paragraphs of Dr. Murray's address, under the heading of "The Atmosphere," but more immediately to the relation between mean atmospheric pressure and prevailing winds. He supposed he had been asked to speak on this occasion from the extensive and minute knowledge of the subject he had necessarily acquired in the preparation of the reports on atmospheric and oceanic circulation which were published as two of the reports of the scientific results of the voyage of H.M.S. *Challenger*.

The former of these reports, on atmospheric circulation, is accompanied by twenty-six maps showing, by isobars for each month and the year, the mean pressure of the atmosphere, and by arrows the prevailing winds of the globe, on hypsobathymetric maps, or maps showing by shadings the height of the land and the depth of the sea; first, on Gall's projection, and second, on north circumpolar maps on equal surface projection. The isobars are drawn from mean pressures calculated for 1366 places, and the winds from even a larger number of places distributed as well as possible over the globe. It may also be noted that the figures showing the averages of pressure and prevailing winds are published with the report, accompaniments to maps of mean atmospheric pressure and prevailing winds of the globe not yet attempted by any other writer who has published such maps.

This, then, is the work undertaken and published in these reports, which occupied seven years in preparing as time could be spared from official duties. The result of the charting of the pressure and prevailing winds is this: Stand with your back to the wind, then the centre of lowest pressure that causes the wind is to the left in the northern hemisphere and to the right hand in the southern hemisphere, a relation well known as Buys Ballot's law. In charting the 1366 pressures and the relative prevailing winds no exception was found in any of the two hemispheres. This is one of the broadest generalisations science can point to, so far as regards what takes place in the free atmosphere.

Some years ago a theory of atmospheric circulation was published by the late Professor Ferrel, which, as it is not accordant with the broad results arrived at in the report on atmospheric circulation in the *Challenger* reports, calls for serious consideration on account of its bearing on any attempt proposed to be undertaken for the exploration of the Antarctic regions.

One of the more recent expositors of this theory is Professor Davis, of Harvard College, who in his *Elementary Meteorology*, Boston, U.S.A., 1894, gives an admirable exposition of the results now arrived at by the various workers in meteorology, and of the opinions and theories promulgated by different meteorologists in different departments of the science. The book is largely used in secondary schools and colleges of the United States, and the views there stated are widely held in America and are spreading into other countries.

The following extracts from Davis's book fairly represent these views:—

"The surface winds of the temperate latitudes, and the high level currents above them, sidling swiftly along on their steep poleward gradients, must all be considered together. They combine to form a vast aerial vortex or eddy round the pole. In the northern hemisphere this great eddy is much interrupted by continental high pressure in winter or low pressure in summer, and by obstruction from mountain ranges, as well as by irregular disturbances of the general circulation in the form of storms" (p. 110).

Now the facts of observation do not support the theory of the existence at any season of the year of a low barometric pressure, or an

eddy of winds, round or in the neighbouring regions of the North Pole. Observations show us no prevailing winds blowing homewards to the region of the North Pole at any time of the year. No low barometric pressure occupies the immediate polar region in any month; but, instead, the opposite holds good for the four months from April to July. In April and May the mean atmospheric pressure is higher in the region of the Pole than it is anywhere in the northern hemisphere north of 43° lat. N.; and in June and July also higher than it is anywhere north of 55° lat. N. Now the higher pressure in these four months necessitates the existence of upper currents in order to maintain this high pressure about the North Pole. These upper currents towards the Pole are exactly opposed to the requirements of the theory that the upper currents in the region of the Pole must necessarily blow not towards but from the Pole.

The actual centre, in this hemisphere, north of the tropic, towards which the winds on or near the surface of the earth blow, is not the North Pole; but in the winter months the low barometric depressions in the north of the Atlantic and Pacific respectively, and in the summer months the low barometric depressions in the Eurasian and North American continents; and the sources out of which the prevailing winds blow in the winter months, the high-pressure regions in Siberia and North America; and in the summer months the high-pressure regions lying northward of these continents, which, as already explained, are virtually the polar region itself. These are the facts in all regions where the winds, according to the theory, become winds blowing over the earth's surface.

As regards the southern hemisphere Professor Davis states that:—

"In the southern hemisphere the circumpolar eddy is much more symmetrically developed." Again: "The high pressure that should result from the low polar temperatures is therefore reversed into low pressure by the excessive equatorward centrifugal force of the great circumpolar whirl: and the air thus held away from the polar regions is seen in the tropical belts of high pressure" (pp. 110, 111).

The meaning of this is that the remarkable low-pressure region of the southern hemisphere is continued southward to the South Pole itself, the pressure diminishing all the way; and that in the region of the South Pole the air currents poured thitherwards along the surface of the earth ascend and thence proceed northwards as upper currents of such enormous intensity and volume that they pile up in the tropical region of the southern hemisphere a mean sea-level atmospheric pressure about an inch and a half higher than the sea-level pressure near the South Pole whence it has started.

Now, to bring the matter to the business which this meeting of the Royal Society has in hand. If this theory were true and supported by the facts of observation, it is plain that no meteorologist could signify his approval of any scheme that could be proposed for exploring the Antarctic regions, it being obvious that these strong west-north-westerly winds, if they blow vortically round and in upon the pole, heavily laden, as they necessarily would be, with the aqueous vapour they have licked

up from the Southern Ocean, would overspread Antarctica with a climate of all but continuous rains, sleet, and snow, which no explorer, however intrepid and enthusiastic, could possibly face.

But is this the state of things? Let it be at once conceded that, as far south as about 55° lat. S., the prevailing winds and the steadily diminishing mean pressures on advancing southward, fairly well support the theory. South of this, however, southerly and south-easterly winds begin to increase in frequency, until from 60° lat. S. into higher latitudes they become the prevailing winds. This is abundantly shown from the winds charted on the maps of the *Challenger* Report, as well as from the unanimous experience of all that have navigated this region from Ross to the present time. Thus the poleward blowing winds from west-north-west in these summer months stop short, distant at least 30° of latitude from the South Pole.

These prevailing south-easterly winds necessarily imply, as has been shown in the analogous case of the North Pole, the existence of a more or less pronounced anticyclone overspreading Antarctica; which in its turn necessarily implies the existence of upper currents from the northward, blowing towards and in upon the polar region to make good the drain caused by the surface out-blowing south-easterly winds. It may, therefore, be concluded that both the surface winds and the upper aerial currents are diametrically opposed to the requirements of this theory.

What is now urgently called for is a well-equipped Antarctic Expedition to make observations which will enable meteorologists to settle definitely the distribution of atmospheric pressure and the prevailing winds of this great region. Were this done, the position in the Southern Ocean of the great ring of lowest pressure that encircles the globe could be mapped out; and since it is towards such a low-pressure ring that the wind-driven surface currents of the ocean flow, a contribution would thereby be made to oceanography of an importance that cannot be overestimated, particularly as regards the great question of oceanic circulation.

Remarks by Sir A. Geikie.

Hardly anything is yet known of the geology of the Antarctic regions. By far the most important contributions to our knowledge of the subject were made by the expedition under Sir James Ross. But as he was unable to winter with his ships in the higher latitudes, and could only here and there with difficulty effect a landing on the coast, most of the geological information brought home by him was gathered at a greater or less distance from the land with the aid of the telescope. Within the last few years several sealing vessels have brought home some additional scraps of intelligence which only increase the desire for fuller knowledge.

As regards the land, merely its edges have here and there been seen. Whether it is one great continent, or a succession of islands and archipelagos, may possibly never be ascertained. We know that in Victoria Land it terminates in a magnificent mountain range with peaks from

10,000 to 15,000 feet high; but that elsewhere it is probably comparatively low, shedding its ice-cap in one vast sheet into the sea.

The rocks that constitute the land are still practically unknown. The dredgings of the *Challenger* Expedition brought up pieces of granite, gneiss, and other continental rocks, and detritus of these materials was observed to increase on the sea-floor southwards in the direction of the Antarctic land. More recently several sealing vessels have brought home from the islets of Graham Land, to the south of the South Shetlands, pieces of different varieties of granite, together with some volcanic rocks and fossiliferous limestones. So far as these rocks have been studied, they do not appear to differ from similar rocks all over the globe. The granites have been found by Mr. Teall to be just such masses as might have come from any old mountain-group in Europe or America.

Among the specimens sent to me by Captain Robertson, of the *Active*, from Joinville and Dundee Islands, which form the north-eastern termination of Graham Land, there was one piece of reddish jasper which at once attracted my attention from its resemblance to the "radiolarian cherts" now found to be so widely distributed among the older Palæozoic rocks, both in the Old World and in the New. On closer examination, this first impression was confirmed; and a subsequent microscopic study of thin slices of the stone by Dr. Hinde proved the undoubted presence of abundant radiolaria. The specimen was a loose pebble picked up on the beach of Joinville Island. We have no means of telling where it came from or what is its geological age. But its close resemblance to the radiolarian cherts, so persistent in the Lower Silurian formations of the United Kingdom, raises the question whether there are not present in the Antarctic regions rocks of older Palæozoic age.

It would be of the utmost interest to discover such rocks *in situ*, and to ascertain how far their fossils agree with those found in deposits of similar antiquity in lower latitudes; or whether, as far back as early Palæozoic time, any difference in climate had begun to show itself between the polar and other regions of the earth's surface.

Among the specimens brought home by Dr. Donald and Captain Larsen from Seymour Island in the same district are a few containing some half dozen species of fossil shells, which have been named and described by Messrs Sharman and Newton, who suggest that they point to the existence of Lower Tertiary rocks, one of the organisms resembling a form found in the older Tertiary formations of Patagonia. Large, well-developed shells of *Cucullæa* and *Cytherea* undoubtedly indicate the former existence of a far milder climate in these Antarctic seas than now prevails.

If a chance landing for a few hours on a bare islet could give us these interesting glimpses into the geological past of the south polar regions, what would not be gained by a more leisurely and well-planned expedition?

But, perhaps, the geological domain that would be most sure to gain largely from such exploration would be that which embraces the wide

and fascinating field of volcanic action. In the splendid harvest of results brought home by Sir James Ross, one of the most thrilling features was the discovery of a volcano rising amid the universal snows to a height of more than 12,000 feet, and actively discharging "flame and smoke," while other lofty cones near it indicated that they too had once been in vigorous eruption. Ross landed on one or two islands near that coast and brought away some pieces of volcanic rocks.[1]

If we glance at a terrestrial globe we can readily see that the volcanic ring or "circle of fire," which nearly surrounds the vast basin of the Pacific Ocean, stretches southwards into New Zealand. The few observations that have been made in the scattered islands farther south show that the Auckland, Campbell, and Macquarrie groups consist of, or at least include, materials of volcanic origin. Still farther south, along the same general line, Mr. Borchgrevink has recently (1894-95) made known the extension of Ross's volcanic region of Mount Erebus northwards to Cape Adare, the northern promontory of Victoria Land. He noticed there the apparent intercalation of lava and ice, while bare snowless peaks seemed still further to point to the continued activity of the volcanic fires. Some specimens, brought by Captain Jensen from Possession Island, were found by Mr. Teall to be highly vesicular hornblende-basalt; while one from Cape Adare was a nepheline-tephrite. This region is probably one of the most interesting volcanic tracts on the face of the globe. Yet we can hardly be said to know more of it than its mere existence. The deeply interesting problems which it suggests cannot be worked out by transitory voyagers. They must be attacked by observers stationed on the spot. Ross thought that a winter station might be established near the foot of Mount Erebus, and that the interior could easily be traversed from there to the magnetic pole.

But it is not merely in Victoria Land that Antarctic volcanoes may be studied. Looking again at the globe, we observe that the American volcanic band is prolonged in a north and south line down the western side of the southern continent. That it has been continued into the chain of the South Shetlands and Graham Land is proved by the occurrence there of old sheets of basalt, rising in terraces over each other, sometimes to a height of more than 7000 feet above the sea. These denuded lavas may be as old as those of our Western Isles, Færoe, Iceland, and Greenland. But that volcanic activity is not extinct there has recently been found by Captain Larsen, who came upon a group of small volcanoes forming islets along the eastern coastline of Graham Land. It is tantalising to know no more about them.

Another geological field where much fresh and important information might be obtained by Antarctic exploration is that of ice and ice action. Our northern hemisphere was once enveloped in snow and ice, yet although for more than half a century geologists have been studying the traces of the operations of this ice covering, they are still far from having cleared up all the difficulties of the study. The Antarctic ice-cap is the

[1] His collections are in the British Museum, but they have never been petrographically studied.

largest in the world. Its behaviour would probably be watched along many parts of its margin, and this research would doubtless afford great help in the interpretation of the glaciation of the northern hemisphere.

To sum up :—Geologists would hail the organisation and despatch of an Antarctic Expedition in the confident assurance that it could not fail greatly to advance the interests of their science. Among the questions which it would help to elucidate, mention may be made of the following :—

The nature of the rocks forming the land of the Antarctic regions, and how far these rocks contain evidence bearing on the history of terrestrial climates.

The extent to which the known fossiliferous formations of our globe can be traced towards the Pole; the gaps which may occur between these formations, and the light which their study may be able to throw on the evolution of terrestrial topography.

The history of volcanic action in the past and the conditions under which it is continued now in the polar regions; whether in high latitudes volcanism, either in its internal magmas or superficial eruptions, manifests peculiarities not observable nearer to the equator; what is the nature of the volcanic products now ejected at the surface; whether a definite sequence can be established from the eruptions of still active volcanoes back into those of earlier geological periods; and whether among the older sheets leaf-beds or other intercalations may be traceable, indicating the prolongation of a well-developed terrestrial flora towards the South Pole.

The influence of the Antarctic climate upon the rocks exposed to its action; the effects of contact with ice and snow upon streams of lava; the result of the seaward creep of the ice-cap in regard to any lava-sheets intercalated in the ice.

The physics of Antarctic ice in regard to the history of the Ice Age in Northern Europe and America.

Remarks by Professor D'Arcy W. Thompson.

The exploration of the Antarctic gives promise of gains to zoological knowledge that are in no degree less, in my opinion, than in the case of the physical sciences. The shore-fauna of the Antarctic we know only by a few scanty collections made upon the islands, especially upon Kerguelen Island; and the fauna of the deep sea is only represented by the produce of eight hauls of the *Challenger's* dredge. These few dredgings gave evidence of peculiarly abundant life; indeed they were said, by common consent of the naturalists of the *Challenger*, to be the richest dredgings in all her voyage: and they were as remarkable for the diversity as for the abundance of the animals they procured. We earnestly desire, and the progress of zoological science needs, further exploration of the deep-sea fauna in all the oceans. Our knowledge of the fauna of the deep sea is only begun; it is known much as the fauna of the shore was known a hundred years ago, and we want to know

more of the undiscovered forms that are peculiar to it, and more of the structure and affinities of those already discovered. But apart from innumerable facts appertaining to systematic or morphological zoology, such as every ocean has yet to yield to us, there are certain great problems of geographical distribution to which the Antarctic is peculiarly likely to give a clue. Lying open to, as it were at the confluence of, all the great oceans, its fauna may co-ordinate and explain many things in the divergent faunas of the Indian Ocean, the Atlantic, and the Pacific. One such problem Dr. Murray has touched upon in his hypothesis of "bipolar distribution," that is to say, of a general similarity and in many cases of actual identity between the animals of the Arctic and Antarctic Seas. This theory has been proclaimed before by others, by Théel, for instance, and by Pfeffer; but others have contested and denied it; for instance, Ortmann in regard to the crustacea, and Chun in regard to pelagic organisms. We could not have a better illustration of the poverty of our knowledge than the circumstance that so broad and clear and simple an issue as the existence or non-existence of a close relation between the Arctic and Antarctic faunas should still be open to dispute.

For my part I think that the bipolar hypothesis is not proven, and I am inclined to think it is untrue. I believe with Ortmann that in the Decapod crustacea at least one form is common to the Arctic and Antarctic Seas; and with Chun and others that there is evidence that similar pelagic forms occurring in the north and south, though not in the surface waters of the tropical seas, are in these latter continued across the torrid zone in the deeper and cooler levels of the sea. I do not think that any single fish, or any Decapod or Isopod, or any certain one out of a large fauna of Amphipods known from the Antarctic Ocean, is also known from the Arctic and adjacent seas. It seems to me, however, that we have some good evidence of very curious similarities between the marine fauna of the Antarctic and that of the North Pacific in the neighbourhood of Japan; and it may be that this is to be in part explained by the existence of a line of communication along the Western American coast, in waters singularly cold for the latitude under which they lie. We know how, in this way, such conspicuous forms as the genus *Scrolis*, the Penguins, the Sea-elephant, the Sea-lions, and the Fur-seals, I might add the giant Sea-weed *Macrocystis*, seem to creep up the American shore, from what was probably their Antarctic home, to Chili, to the Galapagos, or even to the North Pacific and to Japan. But these are illustrations merely of the zoological problems that Antarctic exploration may solve. If the bipolar hypothesis be broken down, it will only give place to other hypotheses as interesting as itself. New facts will give rise to new hypotheses, for further facts to verify or to disprove, and the Antarctic holds for us innumerable problems of which we can foresee neither statement or solution, as well as the solution of those that we can already in some measure foresee.

A HISTORY OF ANTARCTIC DISCOVERY.

By The Acting Editor.

The Southern Hemisphere—Early Theories.

As long as the primitive idea prevailed that the Earth was a flat disc or dome-shaped, and that the land was encircled by the ocean, there could be no question of a southern hemisphere. Africa was supposed to extend to no great distance southwards from the Mediterranean, though the Phœnicians, said to have circumnavigated it in the reign of Pharaoh Necho, are reported by Herodotus, who indeed hesitates to believe the story, to have returned in the third year. When, however, the belief in the sphericity of the Earth obtained acceptance, the ancient geographers regarded the existence of a continent beyond the Equator as a necessity to preserve the symmetry of the Earth's configuration and to counterbalance the weight of the northern continents. Between the hypothetical world and the real they placed a torrid zone, scorched by the sun and enveloped in mist, partly occupied by a channel of water over which it was impossible for man to sail, and they accounted for the volume of the Nile by supposing it to rise in the southern continent, or Antichthone, and, passing beneath the intervening channel, rise to the surface again in the south of Africa. Such is the cosmography of Pomponius Mela, for instance, but opinions varied as to the climate of the tropical regions and the source from which the Nile drew its large volume of water.

Gradually, as Phœnicians, Greeks, and Carthaginians extended their commerce farther in all directions, these views were modified. Greek mariners, among them Diogenes, Theophilus, and Dioscorus, crossed the line along the east coast of Africa, while Flaccus and Maternus, two Roman generals, marched across the Sahara to the country of Agisymba. Marinus of Tyre placed this country in 24° S. lat. and likewise located the Capes Rhaptum and Prasum, on the east coast, much too far to the south. Ptolemy (A.D. 150), in whose works the geography of the ancients reached its highest development, considerably reduced these estimates and places Rhapta, probably near Bagamoyo, on the parallel of the great lakes. South of this the coast, according to Ptolemy, formed a great bay, bent gradually round to the east to Cape Prasum, and confining the Indian Ocean on the south, joined the coast of Asia east of the bay of Tonkin. Off Prasum lay the island of Menuthias, which in the *Periplus* of the Erythræan sea is placed opposite Rhapta, and is perhaps Pemba or Zanzibar. On the west coast Ptolemy is not so well informed, though the Carthaginians traded with the islands in these seas; he mentions, however, two rivers which may possibly have been the Gambia and Senegal, and some distance south of them a great gulf, beyond which the coast trended westwards into the Atlantic.

The Southern Hemisphere in the Middle Ages.

It is well known that in the Middle Ages geography rather receded than advanced among European nations. The Fathers of the Church energetically combated the notion of antipodes, and many of them were equally opposed to the belief in an Antichthone. Being of Greek origin, these ideas were held to be heretical, and as they were connected with the doctrine of the sphericity of the Earth, many ecclesiastics rejected the latter also, while others thought that the southern hemisphere might be occupied entirely by water. Many of the maps of this period showed a reversion to the primitive form, in which Africa was truncated and the ocean flowed in a circle round the world. Still there were scholars who maintained the existence of antipodes, and the discussion was continued down to the sixteenth century. It was, however, generally admitted that the southern continent was inaccessible; the equatorial regions were a burning zone where man could not live, and, according to some speculators, were occupied by a sea shrouded in perpetual mist, agitated by violent storms and peopled by dreadful monsters.

The most prominent geographers of these centuries were the Arabs, and they were, in particular, authorities on the topography of the east, where they monopolised the trade. They adopted the system of Ptolemy, and hence in their maps the Indian Ocean is still bounded on the south by a prolongation of the continent of Africa. But their voyages to China made them to a certain extent acquainted with the Malay archipelago, and though they had no very clear idea of the number, size, and position of the islands, they at any rate ascertained that there was here a free passage to the Chinese coast.

In 1295 Marco Polo returned from his long journey in the East, and in the next century the friar Odoric visited the Malay archipelago, followed a century later by Nicolo de' Conti. Then the islands Java Major, Java Minor, Sumatra, and others begin to appear on European maps, in which the continents are again represented with some approach to their true outlines, the compilers being guided by the reports of travellers instead of baseless speculation. In some of these, as in that of Fra Mauro (1457-59), Asia and Africa are extended far into the southern seas and the southern continent is omitted altogether.

The Southern Continent in the Great Age of Discovery.

The state of knowledge, as far as Africa was concerned, was much the same when Prince Henry the Navigator initiated the series of voyages which eventually led to the discovery of the sea route to the East as it was in the days of Ptolemy. The farthest point known on the west coast was Cape Bojador. From 1418 till his death in 1460 Prince Henry sent forth vessel after vessel, and his captains gradually extended their voyages down the coast. But their progress was slow, and though they discovered many new lands and islands, it was not till after Prince Henry's death that the most important fruits of his prolonged efforts were gathered in. In 1487 Bartholomeu Dias reached Cape Voltas, south of the Orange river; he was then driven from the

coast by storms, and after they had abated, not finding land to the east, he directed his course northwards and struck the coast at Flesh Bay, having rounded the Cape without knowing it. Dias sailed on eastwards as far as the Great Fish river, which he named Rio de Infante after the captain of his second vessel, and was there forced to yield to the remonstrances of his crews, who were alarmed at the turbulence of the sea. He accordingly turned homewards and then sighted the Cape, and in remembrance of the storms he had encountered on his outward voyage called it Cabo Tormentoso, which name was changed by the King, João II., into Cabo de Bona Sperança, as its discovery afforded a hope of reaching the East by sea. Thus it was proved that no connection existed here with a great southern continent.

Though never seen before by Europeans, the Cape had been heard of previously to the voyage of Dias. It appeared on the map of Fra Mauro as the Cavo di Diab, with an inscription that an Indian junk had doubled the Cape in 1420. Pedro de Covilham also, who was sent out by the King in 1487, visited the east and crossed the Indian Ocean to Sofala, where he heard of the island of San Lorenzo (Madagascar), called by the Moors the Island of the Moon (Al Camar), and mentioned also by Marco Polo. He stated that ships sailing down the west coast could reach the extremity of the continent.

Thus the way was prepared for the great expedition of Vasco da Gama, who sailed from Lisbon in 1497. On leaving Santiago, in the Canaries, he steered south-west, probably to avoid the currents and head-winds which earlier Portuguese mariners had encountered in the Gulf of Guinea. Having touched at St. Helena, he rounded the Cape on November 22nd and sailed up the east coast of Africa as far as Malindi, whence, after a voyage of twenty-three days, he reached Calicut on May 17th, 1498.

Seeing that this year the fourth centenary of this notable voyage, which opened to the Portuguese the commerce of the East, has been celebrated, it may be well to say a few words on the later voyages of the great discoverer, though they have no bearing on the subject of this article. In February 1502 he sailed again, with the title of Admiral of the Indies; he was driven by bad weather far to the south of the Cape, but sailing north-east reached Sofala in June, where he heard that in the Kaffir country there was great wealth of gold, silver, and precious stones. The King of Quiloa was forced to recognise the suzerainty of the King of Portugal. Then the Portuguese directed their course to the Arabian Gulf, called at the great port of Cambay, and sailed southwards to Calicut. Having examined the coasts as far as Cochin and Quilon, making inquiries into the products of the country—the cinnamon, spices, and precious metals—and in February 1503 gained a victory over the fleet of the King of Calicut, they set sail for Lisbon, where they arrived in October.

After this second voyage, Vasco da Gama is not heard of for more than twenty years. In 1524 he was appointed Viceroy of the Indies by Dom João III., and set sail for the East with fourteen vessels and 3000 men. Having acted the part of judge and pacificator at Goa, Cannanore, and Calicut, he died on December 24th at Cochin.

In 1500 Pedro Alvarez Cabral was despatched to establish commercial relations between Sofala and Calicut. Following the instructions of Da Gama, he made westwards after passing Cape de Verd, and being driven by a storm farther to the west than he intended, sighted the coast of Brazil, which he named *Terra Sanctæ Crucis*, on April 22nd. In 1501 and 1503 two expeditions were sent out to reconnoitre this new land, in both of which Americo Vespucci took part. By the former, under the command of Gonzalo Coelho, the coast was traced southwards to a considerable distance, and Vespucci claimed to have reached 52° S. lat., and to have navigated a quarter of the circumference of the globe from Lisbon southwards; but his accounts differ, and this statement is open to doubt. At his southernmost limit, he came upon a bleak uninhabited land, maintained by some authorities to have been South Georgia. The second expedition made no new discovery.

Ferdinand Magellan, who had served in the East Indies and accompanied Sequeira in the first voyage made by the Portuguese to Malacca, and perhaps visited the Moluccas with Serrão, held the opinion that the Spice Islands, the goal at which both Spaniards and Portuguese were then aiming, might be more easily and rapidly reached by the south-west than the south-east. As he was treated with little favour in Portugal, he turned for assistance to Spain, and after long negotiations was at length provided with a fleet of five vessels, with which he sailed from San Lucar de Barrameda, at the mouth of the Guadalquivir, on September 20th, 1519. Cape St. Augustin was reached on November 29th, and passing down the coasts, naming many points on the way, Magellan found himself, on October 21st, 1520, off Cabo de las Virgenes at the entrance of the strait that bears his name. Various incidents delayed the vessels on their passage through the straits, which occupied no fewer than thirty-eight days. On emerging into the western ocean, the explorers encountered such calm weather that they named the ocean the Pacific. Sailing northwards to avoid the cold of the southern regions, they afterwards changed their course, and, bearing westwards, came to the Ladrones on March 6th, and then passed on to the Philippines, where Magellan was killed in a skirmish with the natives of the little island of Mactan, on April 27th. After many adventures, his ship, the *Victoria*, was brought home by Juan Sebastian del Cano, who sailed by Borneo, the Moluccas, Timor, and the Cape of Good Hope, and anchored at Seville on September 8th, 1522, having thus accomplished the first circumnavigation of the globe.

A strait through the southern part of South America appeared on a globe before the voyage of Magellan. Two vessels belonging to the Portuguese commercial house of Haro were said to have discovered a strait at about 40° S. lat., and a narrative brought to Augsburg by an agent of the Fuggers was printed with the title *Copia der Newen Zeytung aufs Presillgland*. Hence the appearance of the strait on Schöner's globes of 1515 and 1520, and to the south of it an extensive land named Brasilia Inferior. There is, however, no mention in the *Newe Zeytung* of the names of the captains who made the discovery, of the date of their voyage, and other particulars. Ever since it had been realised that

America was not part of Asia, the discovery of a passage to the ocean beyond had been eagerly looked for, and had often been reported from one part of the continent to the other. Magellan's project, too, may have been heard of, for he had been meditating over it for some years, and about this time laid it before Dom Manoel. It seems then not unreasonable to suppose that either this was another of the vague reports of a passage, or that an endeavour was made to discredit Magellan who was in bad odour at Court. However this may be, Magellan's voyage actually proved that the southern continent was disconnected from America, as it had already been shown to be separated from Asia and Africa.

The Southern Continent appears again on the map of Oronce Finé (1531), with the inscription *Terra Australis recenter inventa sed nondū plene cognita*, and parts of it are styled *Brasielie Regio* and *Regio Patalis*, while in French maps of about the same period—the *Dauphin Chart*, for instance—Java is separated only by a narrow channel from a large country covering a great part of the area really occupied by Australia, and denominated Jave la Grande. The limits of this great Polar continent were gradually restricted; the *San Lesmes*, a caravel of the squadron sent out in 1525 by Charles v. to repeat the voyage of Magellan, was reported to have been driven southwards to the southern extremity of Magellan's Tierra del Fuego, in lat. 55°. But neither this report, nor the experience of Francis Drake, who, after passing through the strait in 1578, was driven by a storm as far south as 56°, and found that the southern land, which was supposed to be part of a continent, was only a collection of islands, and that open sea lay to the south, received much attention from cartographers till the very close of the sixteenth century. The most southern point received its name, Cape Horn (Hoorn) from the Dutch voyagers, Le Maire and Schouten (1615), to whom the names Staten Island and Le Maire Strait are also due.

Meanwhile, the northern coast of New Guinea was discovered in 1545 by Ortiz de Retes, and was assumed to be the northern extremity of the land which nearly touched the South American continent in Tierra del Fuego, while it extended westward to the south of the cape, leaving a broad passage free by which vessels sailed to the Indies. In the Pacific communication had been established between Mexico and the Philippines, but the course of vessels in this trade lay on the northern side of the Equator, and therefore nothing new regarding the Southern Pacific was learned until the Marquis of Mendoza, Viceroy of Peru, despatched in 1567 an expedition under Mendana, the only result of which was the discovery of the Solomon Islands. Again, in 1595, Mendana made a second voyage, accompanied by Pedro Fernandez de Quiros, and discovered the Marquesas and Santa Cruz archipelago. Here Mendana died, and Quiros, instead of holding on his course, which would have brought him to Australia, turned back to America. Another voyage of Quiros led to no better results; in May 1606 he reached the islands named afterwards by Cook the New Hebrides, and, assuming that the mountainous island Merena, some nineteen square miles in area, was part of a continent, called it Australia del Espiritu Santo, and with much ceremony took possession in the name of the King of Spain of all lands between it

and the Pole. One important discovery, however, was made on this expedition. A vessel, under the command of Luis Vaz de Torres, was separated from the rest during a storm, and its captain sailed in August westwards through the strait between New Guinea and Australia. An account of his voyage was sent to Spain, and a copy found its way into the archives of Manila, which was brought to light when the British occupied the town during the Seven Years' War.

The honour of discovering that New Guinea is distinct from Australia belongs, therefore, to Torres, and in the discovery of Australia itself he was anticipated only by a few months by the *Duyfken*, which, under W. Jansz, entered the Gulf of Carpentaria in the early part of the same year. Other Dutch navigators followed, discovering the west coast and Cape Leeuwin, while Pieter Nuyts, Governor of Formosa, discovered in 1626-27 that the coast of Australia turned suddenly eastward beyond this point. After 1611 the Dutch vessels took a southerly course to the east, and there found no land of greater extent than the two small islands St. Paul and Amsterdam. In 1642 Abel Tasman, setting sail from Mauritius, sailed to the south of Australia, landed on the south coast of Van Diemen's Land (now Tasmania), skirted the west coast of New Zealand without discovering that it was an island, or rather, two, and proceeded to Batavia by the northern side of New Guinea. Thus he proved that if a continent existed in the south it could not extend in these regions to the north of 45° S. lat.

The final settlement of the question was reserved for Cook. On his first voyage, after observing the transit of Venus at Tahiti, he sailed in 1770 round New Zealand, surveyed the east coast of New Holland, as Australia was called by the Dutch, and re-discovered Torres Strait. In 1772, before Cook started on his second voyage, Marion Dufresne had discovered the Crozet Islands, which he mistook for a promontory of the Southern Continent, and Kerguelen the island named after him, styling it *La France Australe*. All these supposed discoveries, and the speculations so perseveringly adhered to by advocates of the existence of a Polar continent, were finally disposed of by Cook in his second voyage, when he circumnavigated the globe between 40° and 60° S. lat., and in more than one place touched at the ice barrier of the Antarctic region.

Before passing on to the exploration of the South Polar regions, it may be remarked that of late years the existence of a southern continent connecting Australia and South America in late geological times has been much discussed, the arguments in favour of its existence being chiefly drawn from the present distribution of animal and vegetable life.

The Real Antarctic.

The Falkland Islands, discovered by John Davis in 1522, can hardly be included in the Antarctic, but South Georgia, the South Orkneys, and the South Shetlands are generally considered to fall within its limits. South Georgia, as mentioned above, has been held to be the land sighted by Vespucci in lat. 52° S. La Roche fell in with a land, which may have been South Georgia, but was more probably one

of the Falklands, in 1675, and a Spanish merchant vessel, the *Leon*, sailed round the island group in 1756, which received the name of San Pedro. Of the South Shetlands the discoverer is said by some to have been Dirk Gerritsz, who in 1598 was captain of the *Blijde Bootschap*, in the fleet of Pieter Verhagen. After passing through the Straits of Magellan and sailing for three days northward, the vessels were dispersed by a storm, and Gerritsz was carried, so it was afterwards reported, to lat. 64° S., where he discovered a mountainous snow-covered land. It is suspicious, however, that in the Dutch accounts of Velhagen's expedition, though Dirk Gerritsz is mentioned, nothing is said of this discovery, nor was it recorded on Dutch charts. The earliest date to which the report can be traced is 1622, in which year a translation into Latin of Herrera's *Historia General de las Indias Occidentales* appeared, with a review by the translator, Kaspar van Baerle, of all the voyages made to the Straits of Magellan. In this latter composition the discovery of Gerritsz is for the first time mentioned.[1]

James Cook, 1772-1775. It was on June 22nd, 1772, that Cook sailed from Sheerness on his second voyage, with the ships *Resolution* and *Adventure*, the latter commanded by Captain Furneaux. After calling at the Cape, he set out on November 22nd, in accordance with his instructions, to search for Cape Circumcision, discovered by Bouvet in 1738, and placed by him in lat. 54° S. and long. 11° 20′ E. The weather grew colder as the vessels advanced southwards; on the 10th December an iceberg was seen, and soon after bergs became very numerous. Passing on January 2nd, 1773, near to the position assigned by Bouvet to Cape Circumcision, and seeing no land, though the weather was remarkably clear, Cook concluded that what Bouvet took for land was nothing but icebergs surrounded by floes. On January 15th the thermometer never rose above 36°, and was frequently as low as freezing point.

January 17th was one of the most memorable days in the annals of Antarctic exploration. Between eleven and twelve o'clock the Antarctic circle was crossed by the *Resolution* and *Adventure* in long. 39° 35′ E. Soon after six o'clock on the same day, being in lat. 67° 15′ S., their further progress southwards was stopped by an immense field of ice which extended unbroken from east to west-south-west. Whales, blue, brown and white petrels, and a few sooty albatrosses were seen.

Half the summer being gone, Cook did not think it prudent to continue his exploration of these icy regions. He accordingly ran before the south-east wind, which presently increased to a gale. On February 8th, during hazy weather, the *Adventure* was lost sight of, and the *Resolution*, the wind having changed, was steered south-easterly, reaching lat. 61° 52′ at long. 95° 2′ E., and keeping south of 60° as far as long. 118° (March 6th). On the 16th, Cook resolved to leave the high southern latitudes and make for New Zealand.

In May the *Adventure* was found off Queen Charlotte's Sound, which

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[1] *Das Unbekannte Südland*, Von Prof. Dr. S. Ruge. *Deutsche Geogr. Blätter*, 1895, p. 164.

Captain Furneaux had reached by a more northerly course, and some months were spent among the Pacific Islands. In November, the ships having again parted company, Cook sailed southward from Cape Palliser on another cruise into the southern seas, and on December 12th met with the first ice in lat. 62° 10′, long. 172° W., eleven and a half degrees farther south than the first ice he had seen south of the Cape in the preceding year. With some difficulty owing to the quantity of loose ice, he at length, on December 20th, crossed the Antarctic circle for the second time in long. 147° 46′ W., and on the 22nd reached 67° 31′, the highest latitude hitherto attained. He then sailed north-east through a number of huge icebergs, leaving the Antarctic regions at about 135° W. long., and continuing northwards to below 48°, when he again altered his course to the south. At lat. 62° 34′, long. 116° 24′ W. (January 20th, 1774), a huge iceberg, not less than 200 feet high, with a dome-shaped peak, was observed. At latitude 65° 24′ S. the weather was mild and not a bit of ice in sight, whereas a month before, not quite 200 leagues to the east, the vessel was surrounded by bergs. The Antarctic circle was crossed for the third time in long. 109° 31′ W. on January 26th, 1774, and the next day floes were seen, which on account of a thick fog it was thought dangerous to approach too closely. But on the 30th the fog had dispersed, and the vessel proceeded as far as 71° 10′ S. and 106° 54′ W., where the solid pack-ice completely barred the way, while in the background huge mountains of ice rose one above another.

Cook then returned northwards and passed the remainder of the year in the South Pacific. He then started on his homeward voyage, choosing the route round the southern extremity of South America. He explored parts of the south coasts of the Tierra del Fuegian archipelago, especially Christmas Sound and Staten Island. Then he steered eastwards to ascertain the position of the island of San Pedro, as it had been placed variously in maps. This he reached on January 16th, 1775, and having named it South Georgia and the small islands at its north-western extremity Willis and Birds Islands, he sailed south-eastwards along its northern coast, afterwards turning southwards to the 60th parallel, where icebergs and floes compelled him to turn north-eastwards. On January 31st land was sighted, which on nearer approach took the form of a lofty coast with snow-clad summits, to which Cook gave the name of Southern Thule. Beyond this extended a row of islands so beset with ice that a near approach was impossible. The group lies between 57° and 59° S. lat., and 26° and 27° W. long., and was named Sandwich Land, and it was thought that Ultima Thule might be connected with some of the points seen farther north.

Another attempt was then made to find Bouvet's Cape Circumcision, the *Resolution* sailing as far as 1° E. between 58° and 59° S. lat. with icebergs always in sight. Then the vessel was steered north-east to the assumed position of the cape, but this time with no better success, for as is now known, the Bouvet Islands lie farther to the west. Cook held on his course due eastwards till he came across his old route of 1772, finding this year little ice on this part of the ocean. Having sailed round the Antarctic regions, for the most part at high latitudes, and crossed

the Antarctic circle three times up to the pack, he made for England, taking back irrefragable proof that no extensive southern continent existed. He did not claim to have discovered land within the Antarctic circle, but he argued that the huge table-topped icebergs could only proceed from huge glaciers descending to the sea along the valleys of an unknown land. The land, he thought, must be opposite the South Atlantic and Indian Oceans, for he experienced greater cold on this side of the Pole than on the Pacific side, and this was due to the greater quantity of ice, and hence, he concluded, to the nearer proximity of land.

Lindsay, Hopper, and Smith, 1808 and 1819. After Cook's voyages no expedition was sent out for the purpose of exploration till Bellingshausen sailed from Kronstadt in 1819. Meanwhile some discoveries of importance were made by sealers and merchant captains. The first dates from the year 1808, when James Lindsay, in command of the *Snow Swan*, and Thomas Hopper of the *Otter*, discovered one of the Bouvet Islands, in lat. 55° 15′ S., and long. 4° 15′ E. Seven years later, in 1819, William Smith, on a voyage from La Plata to Valparaiso sailed far to the south in rounding Cape Horn, and sighted a row of islands running between 61° and 63° S. lat. and 58° and 63° W. long., which he named the South Shetlands.

In Valparaiso his vessel was chartered by Captain Shireff of H.M.S. *Andromache*, and placed under the command of Edward Bransfield, who, in 1820, examined the group as far as 53° W. and nearly to 65° S., but did not sight Joinville Island and Louis Philippe Land lying to the south-east. The South Shetlands were immediately after visited by a number of sealers, who contributed much to the determination of their configuration, and made known the west coasts of Palmer Land and Trinity Land.

F. G. von Bellingshausen, 1819-21. Sent out by Alexander I. with the ships *Vostok* and *Mirny*, this Russian captain surveyed the south coast of South Georgia in 1819, and then visited Sandwich Land, where he discovered and named several islands, and found that there was no extended coast land as Cook had supposed. Thence he pushed southwards to 60° 30′ in 28° W., but was forced by drift-ice to retreat twice to the north of the 60th parallel before he reached long. 7° W., when he was able to sail southwards to 69° 21′ in long. 2° 15′. Here he met with a solid wall of ice, and had to direct his course eastwards. Again and again he essayed in vain to gain a higher latitude until the latter days of March, when he crossed the 60th parallel in 88° E. long., and made for Port Jackson.

On December 1st, 1820, he again turned his vessel's head southwards, and on the 10th sighted the first iceberg in lat. 62° 18′ and long. 164° 13′ E. Soon after he came to the pack-ice, and followed its edge south-eastwards amidst numerous bergs. On December 26th, in 67° 20′ S. and long. 161° W., the ice forced Bellingshausen to return to the 60th parallel. Again on January 13th, 1821, he was stopped at lat. 67° 50′ S., long. 120° W., and on the 22nd he attained his most southern latitude, 69° 53′ in long. 92° 19′. Soon after he perceived a steep lofty

land in 68° 57′ S., and 90° 46′ W. He estimated its average height at 4300 feet, and called it Peter I. Island. Another point of coast in lat. 68° 43′ S. and long. 73° 10′ W., which appeared to extend south-westwards, he named Alexander I. Land. Bellingshausen did not attempt to follow the coast farther, but sailed directly north to 66°, and thence passed through the South Shetlands and South Orkneys on his homeward course. He did not attain as high a latitude as Cook, but he crossed the Polar circle six times, sailed for long distances within the circle, and discovered land in two places at least.

James Weddell, 1823. Weddell sailed from the Downs with the *Jane* and *Beaufoy* on a sealing expedition, in 1822. On January 12th, 1823, he came in sight of the South Orkneys, on which he had landed the year before. He now spent ten days in thoroughly exploring the coasts of the islands, and fixing their positions astronomically. Then he steered south-eastwards towards a chain of immense icebergs, which in the distance had been mistaken for land. After sailing southwards as far as 64° 58′ and sighting no land, he returned northwards, thinking to find some between the South Orkneys and Sandwich Land, but on the evening of February 4th, being then within 100 miles of Sandwich Land, he determined to search farther south again. He held on this course till he had attained 74° 15′ S. lat. in long. 34° 16′ 45″ W. At this high latitude, exceeding Cook's farthest by fully three degrees, the sea was open, and only three icebergs visible. The voyage northwards was made rather more to the west, currents running north were observed, and the variation of the compass was found to be very irregular. This voyage added some 14 degrees of latitude to the extent of the known ocean.

John Biscoe, R.N., 1830-32. The brig *Tula*, belonging to Messrs. Enderby of London, sailed under the command of Biscoe on July 14th, 1830. Biscoe first visited Sandwich Land, and then endeavoured to get to the south and west, but could not do so because of the closely packed ice. On the 17th Cook's track in 1773 was crossed, and the ice lay just where he had found it. On February 25th, 1831, there was a distinct appearance of land in lat. 66° 2′, long. 43° 54′ E., but it was soon lost to view among the icebergs. Again on the 27th, in lat. 65° 57′ S. and long. 47° 20′ E., land of considerable extent was seen, but closely bound with pack-ice. Biscoe spent three weeks vainly endeavouring to reach Enderby Land, as it has been called, and then made for Tasmania, having been unable to get within 35 miles of the unknown coast. Early in 1832 he again made for high latitudes, but towards the American side, meeting with icebergs in 60° 45′ S. and long. 132° 7′ W. Continuing south-eastwards he descried land on February 15th in lat. 67° 1′ S. and long. 71° 48′ W. On the following morning it was ascertained to be an island, and was named after Queen Adelaide; during the succeeding fortnight it was proved to be the westernmost of a chain of islands fronting a high continuous land now known as Graham Land. On February 21st Biscoe landed on the mainland, and named some of the highest peaks in the chain of mountains which forms its backbone and was afterwards called Biscoe's range. In 1833 Kemp, another sealing

captain, discovered the land east of Enderby Land, which is named after him.

John Balleny, 1839. The next discovery of land within the Antarctic circle was also made by vessels belonging to the Messrs. Enderby, the *Eliza Scott* and the *Sabrina*. On January 7th, 1839, Captain Balleny steered southwards from New Zealand. Standing south-south-east, he crossed Bellingshausen's route in lat. 63° 37′ S. and long. 176° 50′ E., and here saw the first iceberg. He continued southwards over the spot where compact ice had forced the Russian commander to alter his course, and was not stopped till he had reached lat. 69° in long. 172° 11′ E. He then ran north-west, and about lat. 66° 20′ and long. 163° 50′ E. discovered five islands, the Balleny Islands, the highest of which, Young Island, was estimated to rise in Peak Freeman to 12,000 feet above the sea. Smoke was seen to rise from Buckle Island, and stones brought from Young Island, being scoriæ and basalt, proved the volcanic origin of the group. Balleny then retreated somewhat to the north, but kept about between 63½° and 64½° as he sailed westwards, sighting land to the south in lat. 64° 58′ and long. 121° 8′ E. Then, gradually reaching lower latitudes, he crossed the track of Cook in 1773. The existence of Sabrina Land, as the land just mentioned was called, was somewhat doubtful, as the vessel was some distance off and icebergs numerous. Balleny's voyage filled up a gap of 80 degrees of longitude within the parallel of 60°, which had never been sailed over by any previous navigator.

Dumont d'Urville, 1838 and 1840. The French captain (afterwards Rear-Admiral) made two excursions into the Antarctic regions during a voyage of exploration to Australasia with the ships *Astrolabe* and *Zélée*. On his way out, in 1838, he made southwards from the strait of Magellan, and at the end of February discovered Joinville Land and Louis Philippe Land. He also entered Orleans Channel, but did not find out that it was a strait entirely cutting off Louis Philippe Land from Trinity Land.

His second voyage southwards was made from the Australian side. On January 2nd, 1840, he sailed from Hobart, and after searching in vain for Royal Company Island, met with icebergs in 64° S. lat., the flat-topped form of which gave him hopes of finding land not far distant. On January 21st a coast was clearly visible, and the next day the vessels passed between huge icebergs into open water off the land, which extended south-east and north-west to the horizon, covered with snow, and rising to heights of 3300 to 4000 feet. The tricolour was hoisted on one of a number of rocky islets, and the land (140° to 134° E. long.) was named Adélie Land, after the Queen of Louis Philippe. The coast was followed westwards till the 23rd, when pack-ice forced the vessels to retreat to 64° 48′, and then the westerly course was continued along a barrier of ice 120 to 140 feet in height, in which numerous indentations were visible, but no signs of land. At length, after the barrier had been traced for some eighty miles, the Côte Clarie was discovered, but could not be followed far as pack-ice barred the way. D'Urville then returned to Hobart, having made valuable magnetic and meteoro-

logical observations. Had his vessels been adapted for ice navigation, he would probably have effected more.

Charles Wilkes, 1840. Besides Balleny and D'Urville, Lieutenant Charles Wilkes also was at this season in this part of the Antarctic sea, in command of an exploring expedition sent out in 1838 by the United States of America. In December, 1839, the *Vincennes*, *Peacock*, *Porpoise*, and *Flying Fish* left Sydney, and on January 16th, 1840, came in sight of the barrier in long. 157° 46′ E., at the same time observing, as was afterwards reported, land behind the barrier. The vessels then sailed westwards along the barrier as far as Termination Land, and Wilkes affirmed that he had discovered a great Antarctic continent. His claim gave rise to much dispute, especially as he almost ignored the discoveries of Balleny and D'Urville. A copy of his map was sent to Ross, and reached him at Hobart. Ross, finding himself, in lat. 64° 51′ S. and long. 164° 45′ E., in the midst of a patch of mountainous land laid down by Wilkes in his chart at the eastern end of his supposed continent, and knowing that Wilkes had marked down land wherever "appearances" were recorded in his log, rejected his discoveries altogether, and did not enter them on his chart. There is, indeed, no doubt that at several points Wilkes did actually see land, and the presence of stones and detritus on icebergs proved the existence of land somewhere in the neighbourhood, but some of these points had been previously noted; Cape Carr, for instance, is on Côte Clarie, and Totten Land is merely another name for part of the Sabrina Land of Balleny. "Appearances of land" are very deceptive in the Polar regions, as all explorers have frequently experienced, and therefore many of Wilkes' records of land sighted cannot be accepted as reliable. The ice barrier is certainly an indication of land somewhere in the rear, but at what distance, and whether it consists of islands or a continuous coast, is not easily ascertained when all the hollows are filled with ice of considerable depth. Nevertheless "Wilkes Land" gained acceptance, and still retains its position on maps as the name of a supposed land lying behind all the observed points between Ringgold's Knoll on the east and Termination Land on the west. Wilkes also made a rough calculation of the position of the magnetic pole, placing it, by no means accurately, in about 70° S. lat. and 140° E. long.

Sir James Clark Ross, 1840-43. In 1839 an expedition was equipped for scientific research, the chief object being to observe the magnetic elements in the southern hemisphere, and to search for the southern magnetic pole, which, according to Gauss's opinion, was probably situated about 146° E. long. and 66° S. lat. Other scientific work was not, however, to be neglected; meteorological records were to be regularly kept, and the fauna and flora studied, in which direction great service was rendered by Dr. (now Sir Joseph) Hooker, who accompanied Captain Ross. The ships, *Erebus* and *Terror*, were strengthened to enable them to withstand the shock of the ice, and were provided with the necessary instruments and other apparatus. The commander had already distinguished himself by the discovery of the north magnetic pole.

The southern voyage was commenced from Hobart, where Sir John Franklin, the Lieutenant-Governor, rendered every assistance in his power, as he had also to previous expeditions which had called at the port. Anchor was weighed on December 17th, and running, on the whole, somewhat east of south, the vessels entered the pack, which proved to be 200 miles broad, on January 5th, 1841, at about long. 174° 34′ and lat. 66° 55′ S. Sometimes the pack was close, and fogs were common until on January 9th open water was entered, and on the next day lat. 70° 23′ S. and long. 174° 50′ E. was reached. Then the vessels were steered for the magnetic pole, and on January 11th land was distinctly visible ahead, about 100 miles distant. It rose in lofty peaks following a direction from SSW. to SE. by S. The highest point was named Mount Sabine. Standing south-east to round a compact body of ice, the expedition entered a bay between Cape Adare and Cape Downshire, the former a remarkable promontory with high dark cliffs, contrasting strongly with the rest of the snow-covered coast. The range of mountains, the first land sighted, was called Admiralty Range, and the names of the Lords of the Admiralty were given to its most conspicuous peaks, the westernmost being Mount Dalmeny, some seventy or eighty miles off. Mount Sabine was found by several measurements to be rather less than 10,000 feet high, and about thirty miles from the coast.

Observations of the dip and variation of the compass showed that the magnetic pole lay at a distance of above 500 miles in a south-westerly direction. As there was no possibility of approaching it directly, it was determined to make southwards round Cape Downshire and look for an opening westwards, at the same time reaching a higher latitude. The mainland was covered with ice projecting into the sea, and a heavy surf made landing impossible. Captain Ross and Captain Crozier of the *Terror* (who afterwards perished with Franklin) managed, however, to land on the largest of the islands off the coast, Possession Island, in lat. 71° 56′ S. and long. 171° 7′ E., and took possession of the newly discovered land on behalf of Her Majesty Queen Victoria, after whom it was named. The peaks of a range stretching southwards from Admiralty Range were named after the most illustrious Fellows of the Royal Society and members of the British Association. Between Coulman Island and the mainland the ice appeared not to have broken up for several years, and southwards it extended for a considerable distance from the coast. Franklin Island was passed in lat. 76° 8′ S. It is twelve miles long and six broad, and consists wholly of igneous rocks. On January 27th the bearings of eight separate islands were entered in the log of the *Erebus*, but these afterwards proved to be mountains on the mainland. One of them, an active volcano, 12,400 feet above the level of the sea, received the name of Mount Erebus, while an extinct volcano to the east, 10,900 feet, was called Mount Terror. The most southern land sighted, a range of mountains running southwards from Mount Terror, was named after Captain Sir W. E. Parry, who had paid Captain Ross the compliment of calling the highest point then known in the Arctic regions Ross Island (north of Spitzbergen). From

Cape Crozier, at the foot of Mount Terror, the ice barrier rose in a perpendicular cliff 150 to 200 feet above the sea. It was followed for 250 miles, but no opening could be found in it.

Captain Ross, having reached lat. 78° 4′, then returned to the neighbourhood of Mounts Erebus and Terror, and named a range of mountains in the extreme west, which, if of equal elevation with Mount Erebus, must have been not less than fifty leagues distant and possibly the seat at that time of the southern magnetic pole, the Prince Albert Mountains. Returning northwards, as all the bays were lined with thick ice and no place could be found to winter in, the expedition passed Cape Adare, beyond which solid pack-ice lying off the shore to a distance of eight or nine miles rendered any attempt to land quite useless, and reached the extremity of Victoria Land at Cape North. Then the inner edge of the pack was followed to the Balleny Islands, of which some new ones were discovered, and a north-westerly direction taken, in hopes of finding there a channel leading to the neighbourhood of the magnetic pole. But here also the land was unapproachable, and Captain Ross shaped his course to Hobart.

At the end of the year he paid another visit to high latitudes. He sailed from New Zealand on November 30th, and passing the Chatham Islands met the first iceberg in 58° S. lat. and 147° W. long., five degrees lower than in the previous summer. The pack was entered on December 18th in lat. 60° 50′ long., 147° 25′ W., and the open water beyond was not reached till February 2nd, 1842, after many hard struggles and at great risk. The breadth of the pack this year was about 800 miles, and when it was passed the parallel of 68° had not been reached. The edge still ran south-west, and its westernmost point was not turned till February 16th, in lat. 75° 6′ S. and long. 172° 56′ E. Then the vessels were steered south-east, coming in sight of the great barrier on February 22nd. The following day they were brought to within half a knot of the barrier among bergs and blocks of ice covered with abundant detritus. At this part the barrier was much indented, and its upper edge was not so level as it had been observed farther east in the preceding summer. Its height was also less, being only about 100 feet, and lowering eastwards to 80. Here the vessels reached 78° 9′ 30″ lat. in long. 161° 27′, the most southern point ever visited by man. Over one of the lower spots on the edge the barrier could be seen gradually rising towards the interior, and abutting on a lofty snow-covered range, which, however, Ross would only style an "appearance," as no bare rocks were visible. The barrier was seen to turn north-eastwards, and was edged with compact pack-ice, so that a further advance was impossible, especially as the summer was drawing to a close. During the return northwards a violent gale was experienced among the icebergs, and the vessels came into collision, the spars and rigging of the *Erebus* being severely damaged. The vessels sailed to the Falkland Islands, where magnetic observations were carried out.

A third voyage into the Antarctic seas was commenced on December 17th, the object being to follow the track of Weddell. The first land seen was the southernmost point of Joinville Island, which was named

Cape Fitzroy; and Cockburn Island, off Admiralty Inlet, Louis Philippe Land, was thoroughly examined. Erebus and Terror Gulf was also named. Rounding Cape Seymour the vessels were closely beset by the pack on January 9th in lat. 64° 44′, long. 56° 53′ E., and remained stationary till January 16th. Attempts to penetrate the pack proved ineffectual, and on February 4th a course was laid to the east, and Weddell's track was struck on the 14th in lat. 65° 13′; but instead of clear sea, an impenetrable pack was found here. Farther east the edge of the pack turned more southwards, and at length on March 5th a lat. of 71° 30′ S. was attained in long. 14° 51′ W. Here the pack was dense, and newly formed ice covered the pools, so that the attempt to reach land on this side of the Antarctic was abandoned, and the homeward voyage was commenced.

No such expedition as that of the *Erebus* and *Terror* had ever entered the Antarctic regions, and most of the scientific information about the high southern latitudes is due to the exploration of Captain Ross and his companions. Meteorological records were kept, soundings were taken, and the temperature of the sea observed at different depths, geological and natural history specimens were collected, and, of course, the magnetic observations were very complete, and furthermore were connected with observations made at Hobart and the Falkland Islands.

Voyages since Ross. Since the voyage of Ross, fifty-five years ago, the exploration of the higher latitudes in the Antarctic has been left almost exclusively to sealers and one or two scientific men who have sailed with them. The *Challenger* did, indeed, cross the Antarctic circle in February 1874, proceeding southwards as far as 66° 43′, and sounded and dredged along the edge of the pack; but, the object of the expedition being oceanographical and biological, no attempt was made to reach a high latitude. Pack-ice was reached on February 14th in lat. 65° 30′ S., and long. 79° 40′ E., and then the vessel sailed eastwards among icebergs as far as 94° 23′ E., where Wilkes' Termination Land should have been visible, as its supposed situation was only fifteen miles distant; but, although the sky was clear, no land was visible. Wilkes recorded it only as an appearance of land at a distance of sixty miles, and therefore it is now probable that it has no existence. This was the only geographical observation, the other results of the visit of the *Challenger* belonging to branches of science which are treated of elsewhere.

One other British expedition equipped for scientific purposes has visited the Antarctic seas. Ross having taken magnetic observations around the Pole except between long. 0° and 125° E. or thereabouts, the *Pagoda*, under the command of Lieutenant T. E. L. Moore, was sent out from the Cape to complete the chain. The voyage was commenced on January 9th, 1845, and the 60th parallel was crossed on the long. of 40° E. The most southern point reached was 68° 10′ in long. 35°, where Enderby's Land could not be far distant, but gales and ice prevented any nearer approach. Keeping at as high a latitude as the pack would allow, the *Pagoda* sailed eastwards till March 10th, when she was in 60° S. lat. and 96° E. long. Geographically the results were

negative, as no land was seen. It was only ascertained that from Enderby Land, the coast, if continuous, must bend southwards.

South Georgia was chosen for one of the international Polar stations established in 1882-83. A German expedition under Dr. C. Schrader was sent out in June 1882 and brought away again in September 1883. Besides meteorological observations, extended over fully 350 days, and magnetical observations, surveying operations were executed under Frhr. von der Goltz, while Dr. H. Will studied the fauna and flora of the island.

The neighbourhood of Graham Land has been the principal field of exploration. In 1842 the American sealer, Wm. G. Smiley, proved that Palmer Land is not a part of Graham Land, and in 1873 Captain Dallmann sailed for the south, reaching Graham Land in January 1874. The coast was covered by a huge wall of ice some hundreds of feet high, and there were few places where a landing could be effected. Innumerable rocks, large and small, and some lofty islands skirted the coast. As he sailed southwards, Dallmann became convinced that the land was an archipelago and not a continuous mass. A strait, already discovered by Smiley, running far inland, seemed to cut off Palmer Land from Graham Land, to which he gave the name of Bismarck Strait. As he steamed again northwards Dallmann found the land in all parts divided by bays and inlets, and Trinity Land proved also to consist of a number of islands.

The Antarctic summer of 1892-93 was spent by the Scottish whalers, the *Diana*, *Balæna*, and *Active*, with Messrs. Donald, Bruce, and Burn-Murdoch on board, and the Norwegian sealer *Jason*, under the command of Captain Larsen, in the neighbourhood of Joinville Island and Louis Philippe Land. It was found that the southern portion of Joinville Island was cut off from the rest by a strait. To the new island the name Dundee was given, and the strait received the name of the vessel that sailed through it, the *Active*. No other geographical discovery of any importance was made, but Messrs. Donald and Bruce prosecuted zoological, botanical, and geological investigations as far as was possible in vessels devoted to the catching of seals.

At the end of 1893 Captain Larsen was again in the same region, and this time sailed southwards as far as 68° 10′, in long. 59° 59′ W. On the way southwards land was visible on the west, the east coast of Graham Land, to which he gave the name of Kong Oskar II. Land, while a lofty mountain, the Jason Berg, partially free of snow, stood out conspicuously and projected into the sea in the promontory of Cape Framnäs. On his return from his farthest point, where high land was visible to the south, Captain Larsen found at the northern extremity of Kong Oskar II. Land a number of islands, of which two, Christensen Island and Lindenberg's Zuckerpot, were active volcanoes. Westwards the sea was open except for the ice, so that Palmer and Trinity Land must be of very limited extent. At the same time the *Hertha* (Captain Evensen) sailed down the coast of Graham Land to 69° 10′ S. lat. and 76° 12′ W. long., and sighted Alexander I. Land.

The Norwegian whaler *Antarctic*, fitted out by Mr. H. J. Bull and

commanded by Captain Kristensen, sailed to Victoria Land in the Antarctic summer of 1894-95. It reached the pack on December 8th in lat. 62° 45′ S., and long. 171° 30′ E., and sighted the Balleny Islands on the 14th. Then Cape Adare was visited, where a good view was obtained of the coast of Victoria Land. One of the twenty glaciers in the neighbourhood seemed to be covered with lava, and a volcanic peak, 8000 feet high, had undoubtedly been in activity a short time before. A landing was effected on Possession Island and a lichen was gathered on it, the first vegetation observed within the Antarctic circle. At Cape Adare, the first spot on the Antarctic continent ever trodden by man, the same lichen was found. No whales appearing, it was decided to return northwards, though only 74° S. had been reached, so that no new discoveries of land were made. Some new and valuable information relating to the fauna, meteorological data, and specimens of rock were brought home by Mr. C. E. Borchgrevink and the captain.

Scientific Knowledge of the Antarctic.

Geographical Summary.—The comparatively few vessels which have explored the Antarctic regions have only very partially lifted the veil that hangs over them. Whether there exists an extensive continent beneath the enormous ice-cap, or only a collection of islands, cannot yet be affirmed from actual observation, but the shallowing of the ocean towards the Pole indicates the existence of a plateau on which considerable masses of land are no doubt based. South of America the Antarctic land consists of a series of archipelagos and islands, in which volcanic energy has displayed great activity in the past, and even now has not entirely passed away. Connected by the Burdwood bank, on an average only 110 fathoms below the surface of the sea, with Cape Horn, they seem to form a prolongation of the American cordillera, and are perhaps fragments of a great continent that once connected America with Australasia. In South Georgia, a long island surrounded by a number of small islets and rocks, and running from west-north-west to east-south-east, the geological structure seems, as far as it has been investigated, to point to such a connection. The area of the group may be estimated at 1600 or 1700 square miles, and it rises in the Wetterwand, the highest point seen, to some 7200 feet.

South-east of South Georgia the South Sandwich group of sixteen islands runs from north to south in a curve concave to the west, beginning in 56° 18′ S. lat. and 27° 29′ W. long. with the Savadovski Island, which, at the time of Bellingshausen's visit, was an active volcano rising 1100 feet above the sea, and ending with Southern Thule in 59° 26′ S. and 27° 14′ W.

The South Orkneys extend nearly east and west from Cape Dundas, on Laurie Island, in 60° 47′ S. lat. and 43° 36′ W. long., to the Inaccessible rocks in 47° 12′ W. They consist of Laurie Island, 250 to 300 square miles in area; Coronation Island, nearly twice as large; and a number of smaller islands and rocks. They are almost entirely covered with glaciers, and are of considerable elevation, a mountain on the north-

east coast of Coronation Island having been estimated at over 5000 feet.

The South Orkneys stretch south-westwards between lat. 53° and 63°, and long. 61° and 63° 30′ W. At the eastern extremity the principal are Clarence and Elephant Islands, small in area, but rising to heights of 3500 and 4500 feet, with several islets. Then comes the central group, of which King George and Livingston are the largest and Deception Island the most singular, stretching for a distance of 150 miles. King George, the largest of all, is about fifty-five miles long by sixteen miles broad. Deception Island, discovered in 1829 by Captain Foster of the *Chanticleer*, is a crater into which the sea has found its way, as at St. Paul. It contains hot-springs and fumaroles, which also occur on Bridgman Island, an extinct volcano far to the east of the group. Smith Island, which with Low Island forms the western part of the South Shetlands, separated from the middle group by Boyd Strait, thirty miles broad, is the loftiest of all, culminating in Mount Foster, fully 6200 feet high. The whole group is high, and sinks in most parts steeply to the sea, and its southern slope at least is of volcanic origin. Snow and glaciers cover the greater part of the surface.

The broad Bransfield Strait separates the South Shetlands from the islands known as the Dirk Gerritsz archipelago, consisting of Joinville and Dundee Islands, Louis Philippe Land, Trinity Land, Palmer Land, and numerous smaller islands. Joinville Island has a length, between Cape Moody, in 55° 5′ W., and Cape Kinness, 56° 45′ W., of about fifty miles, and it extends fully twenty miles from north to south. Dundee Island, separated from it by Active Sound, thirty miles long, two to three broad, and of considerable depth, is about twenty-nine miles long, with an average breadth of over four miles. The western part of Joinville Island is comparatively low and even, while the eastern is occupied by Mount Percy, 3600 feet high, from which some of Ros's officers thought they saw smoke arising. The snow and ice which covers all the other parts of this island, as well as Dundee, forms along the sound a wall twenty-five to sixty feet high. Dr. Donald found a schistose rock on Joinville Island *in situ*; on the north shore of Dundee Island debris of granite, sandstone, conglomerate and eruptive rocks, which, if they were not derived from the island, showed that such rocks cannot be far distant.

A large portion of the west coast of Louis Philippe Land towards Orleans Channel is entirely unknown. The island extends from Mount Bransfield, opposite Joinville Island, in 63° 7′ S. and 56° 55′ W., to Snow Land, apparently an island connected with the main island by the ice-cap, its length between these points being one hundred miles or rather more. In the north it rises in Mount D'Urville to 3000 feet, while Mount Haddington in the south, the highest elevation in this region of the Antarctic, is 7000 feet. The eastern coast is indented by two large bays, the Erebus and Terror Gulf, and the Sidney Herbert Bay; Seymour Island is interesting as the only place in the Antarctic where fossils have been found, while Cockburn Island in Admiralty Inlet is the most southerly point where vegetation has been observed, except the lichen found by Mr. Borchgrevink.

South of Louis Philippe Land is situated the northern point of Graham Land, or Oskar II. Land, with numerous islands discovered by Captain Larsen lying off the coast, two of which are active volcanoes—Christensen Island and Lindenberg's Zuckerpot. Oskar II. Land is comparatively low in the north, but rises to a considerable height in the Jason Berg. Farther south are four ranges named by their discoverer Foyn Land. The coast runs south-south-west as far as Foyn Land, then advances eastward to 60° 40′ W. in lat. 67° S., whence it continues south or south-south-east into the unknown.

Of Trinity Land and Palmer Land, between Orleans Channel and Bismarck Strait, and separated from one another by Hughes Gulf, very little is known. They are hilly and covered with ice and snow, and the gulf and strait are beset with numerous islands. That Hughes Gulf converges with Bismarck Strait into an open sea between these islands and Louis Philippe Land and Oskar Land, is a conclusion drawn solely from Captain Larsen's observation on Christensen Island.

Still less is known of Graham Land. It seems, from the reports of Biscoe, Evensen, and others, to be a hilly ice-covered land apparently continuous. Here, too, numerous islands line the coast, the Kaiser Wilhelm Islands in Bismarck Strait, the Biscoe Islands farther south and out to sea, and finally Adelaide Island, a rocky ridge some five miles long. More than a degree farther south is Bellingshausen's Alexander I. Land, and a few miles off, in lat. 68° 57′ and 90° 46′ W., Peter I. Island, about eleven miles long by five broad, and rising to a height of over 4000 feet. Beyond this point no land has been sighted until Ross's Victoria Land is reached, unless Cook's Ne Plus Ultra in lat. 71° 10′ S. and long. 106° 54′ W. is land, which seems not unlikely, though the explorer did not claim the discovery.

More than fifty-four degrees of longitude separate Cook's Ne Plus Ultra from the point where Ross sighted the last appearance of land in 71° 10′ S. and 161° 27′ W., and 300 miles of ice-barrier extend thence to the southern point of Victoria Land. Both in extent and in elevation this land is the largest mass yet discovered in the Antarctic. From Cape Adare, in lat. 71° 18′ S., the coast, indented with numerous fiords, runs north-westwards for 120 miles to Cape North, and then apparently turns south-westwards, begirt by a lofty ice-barrier. In this direction Ross saw several elevations which he thought were probably mountains. On the other side the coast runs southward from Cape Adare as far as Cape Cotter, indented here also by deep bays, and then inclines to the south-west, the bays becoming broader and shallower, and from Cape Washington it sweeps in a long curve round to M'Murdo Bay on the western side of Cape Bird and Mount Erebus, beyond which it merges near Cape Crozier into the barrier, 450 miles or more from Cape Adare. Over the whole length the background is occupied by mountains of great height, from Mount Elliot, behind Yule Bay, in the north, to Erebus and Terror in the south. They attain heights of 12,000 feet and over, Mount Erebus measuring 12,400, while Mount Melbourne is probably still higher, though Ross could not approach it sufficiently near to estimate its height. The valleys between these giants are filled with

snow drifted down from their summits, which are almost all, except the active volcanoes, shrouded in snow. Only the steep basaltic cliffs of Cape Adare are exposed. Even Mount Erebus, one of the loftiest volcanoes of the world, is covered with snow up to a few hundred feet from the crater, which occupies the summit. Mount Terror, however, is much freer from snow. The ice-barrier, 150 to 200 feet above the sea, is level on its upper surface, and probably its outer edge floats on the sea, for Ross sounded 410 fathoms east of Cape Crozier, whereas he found much shallower water between Franklin Island and M'Murdo Bay, as also farther north.

Nearly 300 miles north of Ross's most westerly point lie the Balleny Islands, a group of volcanic origin, probably on the same line of weakness as the Possession and other islands. They consist of three large and four small islands, and their highest peak, Mount Freeman, is, as stated above, estimated at about 12,000 feet in height.

It seems by no means improbable that Victoria Land may join Wilkes' Land on the west, forming one continent, if the latter is really a continuous mass. The most easterly point actually ascertained to be land is situated in about 67° S. lat. and 158° E. long., where Ringgold's Knoll and another conical peak were seen, while the westernmost point, Knox Land (Termination Land having probably no existence), is some 1700 miles to the west. In long. 154° 30′ a deep bay was entered by the *Vincennes*, where a sounding of 500 fathoms was taken by the *Peacock*. Next succeeds the Adélie Land of D'Urville; it has a fairly uniform elevation of not less than 3000 feet, and its coast has been seen for a distance of 120 or 130 miles. Apparently, from Wilkes' observations, it joins the Clarie coast. Then comes North's High Land, separated only by Porpoise Bay, followed by Sabrina Land. Budd's High Land, a lofty range, and Knox's High Land, succeed one another at greater intervals. The land has throughout an elevation of 3000 feet or more, and is begirt by an ice-barrier about 100 feet high, and therefore much lower than the huge wall east of Victoria Land.

Westwards there is again a long interval of nearly forty-five degrees of longitude, where the presence of land at no great distance beyond the sixty-eighth parallel can only be inferred from the dredgings of the *Challenger*. In lat. 66° 25′ and long. 59° E. lies Kemp Land, a coast some thirty-five miles in length, of which nothing further is known. Enderby Land was first sighted in long. 47° 20′ E. and lat. 65° 57′ S., and a conspicuous promontory on long. 49° was named Cape Ann; its exact length is uncertain. From Enderby Land the coast must turn southerly, or Moore would have sighted it, and must run at a high latitude towards Graham Land, seeing that Weddell saw neither land nor ice at 74° 15′ S. This is all that can be stated about the Antarctic between the longitudes of 40° E. and 60° W. A glance at the map will show how small a fraction of Antarctica, whether it be ice, continent, or islands, which has been estimated to occupy an area of 400,000 square miles, has been seen by man.

Geology.—Scientific observations in this and other sciences have been very few, and little can be added to the general sketches given by

Sir John Murray and other speakers at the meeting of the Royal Society. Recent volcanic rocks are nearly everywhere predominant; and volcanoes actually active or not long extinct are present in nearly all parts. They have not yet been observed in South Georgia, and the western part of Wilkes Land and Enderby Land do not present the well-known conical forms. South Georgia alone has been subjected to a somewhat closer examination by Dr. Will of the German polar station. In the neighbourhood of Royal Bay phyllite lies along the coast in layers alternating with phyllite-gneiss; then follow southwards clay-slates alternating with quartzite, and near the Weddell glacier half-crystallised shales, enclosing thick layers of schalstein as well as sandstones. These rocks slope south-westwards or towards the longer axis of the island, and more steeply in the interior than on the coast, and have probably assumed a metamorphic character under pressure. Fossils have not been found, but the presence in the rocks of carbon in microscopic particles indicates that fossils were formerly enclosed in them. Weddell's Island, in the South Orkneys, has a somewhat similar structure, as far as D'Urville's rapid examination shows, and Smith speaks of a bluish-grey schist in the South Shetlands. The rocks found by Dr. Donald on Joinville and Dundee Islands have already been alluded to by Sir A. Geikie, as well as the fossils collected by Captain Larsen on Seymour Island. Non-volcanic rocks have also been found on the other side of the Pole. Off Victoria Land the sounding-lead of the *Erebus* brought up a fragment of granite. On small islands off the Adélie coast D'Urville found a crystalline rock—gneiss or amphibolite. The *Challenger* made three soundings in high latitudes, between the parallels of 64° and 66° in depths of 1675, 1800, and 1300 fathoms, and brought up blue mud and fragments of rock bearing marks of glacial action. These consisted of granite, quartz diorite, diorite schist, amphibolite, mica-schist, sandstone, compact limestone, and shales—all continental rocks. Eruptive rocks of recent origin were nowhere found in high latitudes on this side of the Pole.

Meteorology.—As the midsummer of the southern hemisphere occurs near the time of perihelion, when the velocity of the earth is at its greatest, the summer of the south is shorter than on this side of the equator, the sun being 179 days south of the equator, and 186 on the northern side. Consequently it may be inferred, *à priori*, that the climate of the Antarctic is colder than that of the northern Polar regions. Another very important difference between the circumpolar regions is that, whereas the Arctic ocean is closely shut in by land, the ice-covered Antarctic continent lies in the midst of a great ocean, the nearest land being the narrow extremity of South America. It should, therefore, possess an oceanic climate, one, that is, in which the extremes of temperature are modified and the range is small, with a large precipitation. No observations have been made in winter within or very near the Antarctic circle; but such as have been recorded in the surrounding ocean, or in high latitudes in summer, are in accordance with the above conditions. Ross was in the Antarctic regions between the parallels of 62° and 78° in the Februarys of 1841-43, and only on eighteen days did

the thermometer rise above freezing-point. At the Sixth International Geographical Congress, Dr. G. Neumayer showed by comparing the records of vessels in corresponding latitudes that the temperature both of air and water in the higher latitudes is 14½° to 18° lower in the Antarctic Ocean. The lowness of the temperature is also evidenced by the observations of the German polar station in South Georgia, where the mean for the year was 34·5°, for the warmest month, February, 41·5°, and for the coldest, June, 26·8°; and this in a latitude as low as 54°. The vast expanse of ice which reduces the temperature of the surrounding waters by means of winds and currents, and the frequent fogs obscuring the sun in high latitudes, are no doubt contributory factors.

The oceanic character of the climate is indicated by the closer parallelism of both the isobars and isotherms, as compared with those of the northern hemisphere, and the narrowness of the belt through which each moves in the course of the year. The higher isotherms, indeed, which alone can be drawn for all seasons, for data are wanting from high latitudes for the winter months, further confirm this oceanic character by the irregularities they exhibit in the neighbourhood of large masses of land, especially Australia, which, extending over many degrees of longitude and being comparatively low, forms a reservoir of heat.

Nothing is known of the quantity of precipitation. In summer on the sea and along the coasts it must be considerable. Ross noted south of 70° showers on 31 per cent. of the days, and Wilkes and D'Urville speak of heavy rain in lower latitudes. Snow, however, is, owing to the coldness of the climate, the more common form, and Ross records snow on a large proportion of the days he spent in high latitudes. Towards the interior and in winter the precipitation must be very small. From such a vast expanse of ice, however, there must be considerable evaporation, rendering the relative humidity of air, as in the Arctic regions, very high, and it is not impossible that the upper currents of air flowing to the anticyclonic area of the Pole may bring moisture with them which will fall in the form of ice-needles.

Atmospheric pressure in its most important aspect has been discussed by Dr. Buchan in the preceding article.

Magnetism.—About 1838, Professor G. Gauss set forth his theory of earth magnetism, and thereby gave an impetus to magnetic observation which resulted in the expeditions of Ross and Moore. The position of the south magnetic pole, as calculated by Professor Gauss, was 72° 35′ S. and lat. 152° 30′ E. long., but the dip at Hobart Town being higher than calculated, it was anticipated that its actual position would be found in about lat. 66° S., and long. 146° E. Ross's observations, however, placed it in 75° 5′ S. and long. 154° 8′ E., or about 2½° south of the computed position. The observations of Ross, Moore, D'Urville, and Wilkes enabled physicists to draw the curves of the magnetic elements in the Antarctic region with much greater accuracy than before, and the subsequent observations of the *Challenger* and the German station in South Georgia have added to the necessary data, but Ross was not within some hundreds of miles of the magnetic pole, which, moreover, is

constantly changing its position, and the science of Earth magnetism has made considerable progress in the interval, so that its demands for accurate and numerous records are more pressing, and a new calculation of the elements from the latest data has not been found satisfactory.

It is an interesting fact that Vespucci is the first to mention the Aurora Australis, and this lends some colour to his statement that he reached 52° S. On this side, however, it is a somewhat rare phenomenon, no display having been seen in the year 1882-83 at the polar station in South Georgia, or at the French station near Cape Horn. On the other side of the Pole it is more frequent owing to the proximity of the magnetic pole, and was witnessed by Cook and most other navigators.

Antarctic Expeditions in Progress and Projected.

At the present time two expeditions have already left Europe. M. de Gerlache, a Belgian, sailed last year in the *Belgica*, a vessel built in Norway expressly for exploration amidst the ice, and arrived at Punta Arenas on December 1st. He intended to leave the Magellan Straits by the Cockburn Channel and steer southwards to Alexander I. Land, then follow the Antarctic circle as closely as possible to Victoria Land, where a party was to be landed to spend the winter; the *Belgica* was to pass the winter at Melbourne. The plan was altered when the vessel was at Lapataia, a few leagues east of Ushuaia, Graham Land being the new destination. In March it was reported that the vessel had run aground near Harbourstown at the entrance of the Beagle Channel, but had soon got off, and had put into the port of St. John. Next a letter from one of the scientific staff, dated January 13th, stated that the *Belgica* was to sail from St. John the following day for Graham Land, and that it would return in April to fetch the zoologist and doctor who were studying the fauna and flora of Tierra del Fuego. Since then nothing has been heard of the expedition, and it is feared that it has met with some disaster.

The other expedition has been equipped by Sir George Newnes, and is under the leadership of Mr. C. E. Borchgrevink. It sailed from London in a Norwegian whaler, renamed the *Southern Cross*, at the end of August for Hobart, whence it will after as short a delay as possible start for Cape Adare. Here Mr. Borchgrevink and his companions will erect a station, and will then make a land journey in the direction of the magnetic pole, for which purpose ninety dogs obtained in Russia have been taken in the *Southern Cross*. The distance to be traversed is estimated at 150 miles. The leader will return to Cape Adare before the Antarctic winter, and his party will be taken on board the *Southern Cross*.

In Germany the organisation of an Antarctic expedition has been vigorously promoted. A committee has been appointed with Professor G. Neumayer as convener, and Dr. Erich v. Drygalski, well known through his studies of the Greenland ice, has been appointed leader of an expedition, which, it is proposed, shall set out in August 1900. The

members of the expedition are to number twenty-five, five of them constituting the scientific staff. It will steer southwards along the meridian of Kerguelen and will make observations in all branches of science—oceanography, meteorology, zoology, magnetism, pendulum observations, etc. A whole year, at least, is to be spent at a fixed station, where during the spring and summer excursions will be made along the coasts and towards the Pole. In June 1902 the expedition will start on its voyage home. The funds for the expedition have not yet been raised, but, as the original plan has been modified, one vessel only being now asked for and the time reduced to two years, it is hoped that little difficulty will be met with in obtaining the means of carrying it out.

It is much to be desired that a British expedition, thoroughly equipped for oceanographic research and for scientific investigation on land, should be sent out the same year. The importance of simultaneous magnetic observations and of meteorological records in the same years at different parts of the Antarctic is self-evident. Hitherto this country has contributed far more than any other to the exploration of the Antarctic, and it is to be hoped that it will not now leave all the work to others.

THE FAUNA AND FLORA OF THE ANTARCTIC.

By James Chumley, of the *Challenger* Expedition Office.

In the succeeding pages will be found lists of the Whales, Seals, and Birds recorded from the Southern seas, together with a few notes on the marine Metazoa and Protozoa, and on the land and marine vegetation.

a. CETACEA.

The species of whales known from the Southern regions are :—

Balæna. The species described as *biscayensis*, *australis*, *novæ-zealandiæ*, and *japonica* all belong to one and the same species, which inhabits the temperate seas of both northern and southern hemispheres.

Neobalæna marginata, a very rare species from Australian and New Zealand seas.

Megaptera. The Humpback whales have been divided into many species, but no satisfactory characters have yet been pointed out by which these can be distinguished from one another ; they have been recorded from the North and South Atlantic, and North and South Pacific.

Balænoptera, the Rorquals recorded from the Southern Ocean are almost, if not quite, identical with those found in the British seas.

Kogia breviceps, various species described from distant localities in the Southern Ocean, and also off the coast of Madras, and in the North Pacific, are all referable to this species.

Ziphius cavirostris has been found in the seas around New Zealand and

the Chatham Islands, Cape of Good Hope, Buenos Ayres, and also at the Shetland Islands.

Mesoplodon. The existing species of this genus are widely distributed in both the northern and southern hemispheres, but there is much dubiety regarding their distinctive characters.

Berardius arnouxi, a rare species found in the New Zealand seas.

Orca. The Grampus is met with in almost all seas from Greenland to Tasmania, but the number of species and their distinguishing characteristics are very uncertain.

Pseudorca crassidens, a rare species known hitherto from Tasmania and the coast of Denmark.

Globiocephalus. Specimens of the Pilot whale from the Australian coasts are quite indistinguishable, either by external or osteological character, from those from the North Atlantic.

Grampus richardsoni, a skull from the Cape of Good Hope described under this name differs very slightly from that of *G. griseus* of the North Atlantic and Mediterranean.

Delphinus forsteri described from the Australian seas is closely allied to, if not identical with, *D. delphis* the common dolphin of the Mediterranean and North Atlantic.

„ *peronii* from the South seas is remarkable for the absence of the dorsal fin.

The Greenland whale, *Balæna mysticetus*, though eagerly sought for of late, has not been observed.

b. SEALS.

The seals known from Southern seas are :—

Ogmorhinus leptonyx (leopard seal).

„ *carcinophagus* (crab-eating or saw-toothed seal).

Leptonychotes weddelli (Weddell's seal).

Ommatophoca rossi (Ross's seal).

Macrorhinus leoninus (elephant seal); this species is supposed by some naturalists to be identical with *M. anguirostris* described from California.

Otaria jubata (sea-lion).

Eumetopias hookeri (Auckland Island hair-seal).

„ *cinereus* (grey sea-lion of New Zealand and Australia).

The other two species of this genus belong to the northern hemisphere, viz., *E. stelleri* from the North Pacific, and *E. californianus* from California.

Arctocephalus australis (South American fur-seal).

„ *gazella* (Kerguelen fur-seal).

„ *pusillus* (fur-seal of the Cape and Crozets).

„ *forsteri* (fur-seal of New Zealand and Australia).

„ *philippii* (fur-seal of Juan Fernandez).

The only other species of this genus is *A. ursinus*, the well-known fur-seal of Alaska.

c. BIRDS.

The following birds have been recorded from Southern regions, those distinguished by an asterisk (*) having been observed in the far south near Antarctic ice :—

**Chionis alba* (kelp pigeon).

„ *minor* (sheath-bill).

Sterna antarctica (tern).

* „ *hirundinacea* (black-headed tern).

Sterna virgata.
„ *vittata.*
**Larus dominicanus* (gull of Kerguelen).
„ *glaucodes.*
* „ *scoresbyi.*
**Stercorarius antarcticus* (skua).
„ *chilensis.*
* „ *maccormicki.*
Diomedea exulans (white albatross).
* „ *fuliginosa* (sooty albatross).
„ *melanophrys* (molly mauk).
**Oceanites oceanicus* (Wilson's petrel).
Fregata melanogastra.
**Majaqueus æquinoctialis* (Cape-hen or black night-hawk).
**Thalassœca antarctica.*
* „ *glacialoides.*
**Ossifraga gigantea* (giant petrel).
Pelecanoïdes garnoti.
„ *urinatrix* (diving petrel).
Œstrelata brevirostris.
„ *lessoni* (mutton-bird).
**Daption capensis* (Cape pigeon).
Prion banksi (dove-petrel).
* „ *desolatus* (whale-bird).
* „ *turtur.*
* „ *vittatus.*
**Pagodroma nivea* (snowy petrel).
Querquedula eatoni (Kerguelen teal).
Phalacrocorax imperialis.
„ *verrucosus* (shag).
**Aptenodytes forsteri* (emperor penguin).
„ *longirostris* (or *pennanti*) (king penguin).
Spheniscus demersus (jackass penguin).
„ *magellanicus.*
**Pygoscelis adeliæ.*
* „ *tæniata* (Johnny penguin).
**Eudyptes antarctica* (ringed penguin).
„ *chrysocome* (rock-hopper penguin).
„ *chrysolophus* (macaroni penguin).
**Bernicla antarctica* or *magellanica* (?).
*A crow (?).

Though there is no evidence of specific identity between the birds of the Arctic and Antarctic regions, several of the genera (*e.g. Sterna, Larus, Stercorarius, etc.*) have representatives in the far north.

d. MARINE METAZOA AND PROTOZOA.

Our knowledge of the marine fauna of the South is to a large extent due to the investigations of the *Challenger* Expedition, during the cruise from the Cape of Good Hope to Australia. The results have been exhaustively and systematically treated by Sir John Murray in the paper quoted in the Bibliography on the Marine Fauna of the Kerguelen Region. We shall here attempt to show the extent of our knowledge by summarising the elaborate lists given in that paper (to which the reader is referred for details), dealing, first, with the Metazoa of the deep sea (over 1000 fathoms) ; second, with the Metazoa of moderate depths (150 to 1000 fathoms) ; third, with the Metazoa of shallow water (from the shore down to 150 fathoms) ; fourth, with the pelagic Metazoa ; and lastly, with the Protozoa.

Life in the deep sea of the South seems to be present in extraordinary abundance and variety ; thus at eight deep-water trawlings and dredgings, in depths between 1260 and 2600 fathoms, lying between lat. 42° 42′ S. and lat. 65° 42′ S., no fewer than 272 species and varieties of marine Metazoa were procured, representing 186 genera. In no other region of the ocean basins traversed by the *Challenger* did any similar series of deep hauls indicate such a profusion of animal life. The number of species taken in one of these hauls was 89, and the average number in the eight hauls was 34 species per haul ; for the sake of comparison, it may be stated that the average number of species of Metazoa procured by the *Challenger* in all the remaining deep hauls over 1000 fathoms south of the southern tropic, outside this Kerguelen region, was about 10 species per haul.

Among these 272 species all the classes of marine invertebrates and fishes

were well represented. Thus, of Sponges there were 19 species (Monaxonida 7, Tetractinellida 1, Hexactinellida 11); of Cœlenterata 23 species (Alcyonaria 1, Pennatulida 2, Antipatharia 1, Actiniaria 9, Corals 2, Hydroida 3, Medusæ 4, Siphonophoræ 1); of Echinodermata 87 species (Crinoidea 8, Asteroidea 19, Ophiuroidea 16, Echinoidea 13, Holothurioidea 31); of Vermes 26 species (Entozoa 2, Nemertea 1, Gephyrea 1, Annelida Polychæta 19, Myzostomida 3); of Crustacea 59 species (Ostracoda 9, Cirripedia 6, Amphipoda 5, Isopoda 14, Phyllocarida 1, Schizopoda 7, Macrura 6, Anomura 3, Pycnogonida 8); of Mollusca 23 species (Lamellibranchiata 9, Scaphopoda and Gasteropoda 11, Cephalopoda 3); of Polyzoa 9 species, of Brachiopoda 1, of Tunicata 11, and of Fishes 14 species.

In moderate depths (*i.e.* between 150 and 1000 fathoms) the *Challenger* took three dredgings in the Kerguelen region, near Marion Island and the Crozet Islands, in depths varying from 210 to 550 fathoms. The number of species of Metazoa obtained in these three dredgings was 68, and with five exceptions each individual species was the representative of a distinct genus. Among these 68 species there were of Sponges 13 species (Monaxonida 8, Hexactinellida 5); of Cœlenterata 13 species (Alcyonaria 9, Antipatharia 2, Corals 2); of Echinodermata 12 species (Asteroidea 3, Ophiuroidea 5, Echinoidea 1, Holothurioidea 3); of Annelida Polychæta 2 species; of Crustacea 8 species (Amphipoda 1, Isopoda 2, Macrura 1, Anomura 4); of Mollusca 4 species (Lamellibranchiata 1, Gasteropoda 2, Chitons 1); of Polyzoa 13 species, of Brachiopoda 1, and of Fishes 2 species.

In shallow water (from the shore down to 150 fathoms) the *Challenger* took many dredgings and trawlings in the Kerguelen region, off Marion and Prince Edward Islands, off Kerguelen, and off Heard Island. The total number of species and varieties of Metazoa procured in these shallow hauls was 533, belonging to about 325 genera. Among these 533 species, there were of Sponges 34 species (Monaxonida 23, Tetractinellida 5, Hexactinellida 1, Calcarea 5); of Cœlenterata 28 species (Alcyonaria 5, Actiniaria 4, Hydroida 19); of Echinodermata 62 species (Crinoidea 5, Asteroidea 25, Ophiuroidea 16, Echinoidea 5, Holothurioidea 11); of Vermes 50 species (Entozoa 2, Nemertea 6, Gephyrea 1, Annelida Polychæta 41); of Crustacea 145 species (Ostracoda 43, Cirripedia 2, Amphipoda 48, Isopoda 39, Cumacea 5, Schizopoda 2, Macrura 2, Anomura 1, Brachyura 1, Pycnogonida 5); of Mollusca 105 species (Lamellibranchiata 27, Scaphopoda and Gasteropoda 71, Chitons 2, Nudibranchiata 2, Marseniadæ 2, Cephalopoda 1); of Polyzoa 57 species, of Brachiopoda 6, of Tunicata 35, and of Fishes 11 species.

Besides Protozoa, Algæ, etc. (to be briefly referred to later on), the *Challenger* naturalists observed in the surface waters of the Southern Ocean representatives of Medusæ, Siphonophoræ (*Diphyes*), Hydroids (on floating seaweed), Ctenophoræ, Holothurians (on floating *Macrocystis*), Worms (*Pelagonemertes*, Planarians, *Sagitta*, *Alciopa*, *Tomopteris*), Ostracoda (*Halocypris*), Copepods and Amphipods in great variety and abundance, *Lepas* (on floating pumice), Isopods, Schizopods abundant, Macrura, Lamellibranchs and Gasteropods (on floating seaweeds), Heteropods and Pteropods (*Atlanta*, *Clio*, *Limacina*, *Spongiobranchæa*), Cephalopods (*Cranchia* and *Taonius*), Polyzoa (on floating seaweeds), Tunicates (*Appendicularia*, *Salpa*, *Pyrosoma*), and Fishes (young *Prymnothonus*, *Sternoptyx*). In lat. 47° S. the water was quite red-coloured, due to innumerable red Copepods, which were captured in so thick a mass that it was impossible to see the other organisms present.

As regards Protozoa, many Foraminifera of small size and compound and other Radiolaria were invariably observed in the tow-net gatherings in the South, and their dead shells and skeletons formed part of the deposits at the bottom. The number of species and varieties of Foraminifera observed in the deposit samples brought home by the *Challenger* from the Antarctic regions south of lat. 40° S.,

from shallow water down to 2600 fathoms, amounts to 220, of which 10 were of pelagic origin. The species of Radiolaria were determined in the surface gatherings and in the bottom samples brought home from the *Challenger* station in lat. 54° S., depth 1950 fathoms. Out of a total number of 93 species of Radiolaria observed at this Station, 69 species were procured only in the deposit, 12 species were obtained only in the surface gatherings, while the remaining 12 species were noted both at the surface and bottom. Thus of the 24 species detected in the surface gatherings, 12 were observed also in the deposit at the bottom, but the other 12 species belong to the classes Acantharia and Phæodaria, the skeletons of which are composed of substances comparatively readily soluble in sea-water, and are therefore seldom met with in bottom deposits.

c. THE FLORA.

When in lat. 65° S., the *Challenger* naturalists observed the water to be of a greenish colour, which on examination was found to be due to myriads of minute spherical transparent Algæ (*Tetraspora poucheti*), identical with Algæ observed in the Arctic Ocean. The surface waters of the far South teemed with Diatoms, and the *Challenger's* tow-nets were often filled with a yellowish slime (almost entirely composed of Diatoms), which dried into a whitish, felt-like mass. The most abundant form was the peculiar, very elongated, flexuous *Thalassiothrix longissima*, var. *antarctica*, a species which has been recorded as forming large floating masses in the Arctic Ocean. In the Antarctic its frustules were found arranged in little bundles of from ten to twelve, fastened together loosely at one end, but separate at the other, the whole being loosely twisted into a spindle; it is, along with *Chatoceros remotum*, the most characteristic species found on the surface of the Antarctic seas. The number of species and varieties of Diatoms observed in the deposits collected by the *Challenger* at three shallow-water localities and one deep-water station in the Kerguelen region was 187, and the number observed in the surface gatherings brought home from a station in lat. 54° S. was 51. Thus, out of a total number of 213 species, 26 were noticed both at the surface and at the bottom, and 25 on the surface only, the remainder being recorded only from the deposit. Fifteen of the species of Diatoms from these Antarctic localities are known also from Arctic regions.

The seaweeds of the Antarctic are closely related to those of the Arctic; in fact, 54 species have been recorded as common to the northern and southern oceans but not occurring within the tropics. Three species may be especially mentioned—*Macrocystis pyrifera*, *Lessonia fuscescens*, and *Durvillea utilis*. The first occurs in all parts of the ocean from lat. 40° to 64° S., and attains an enormous length, specimens having been seen by Hooker of fully 700 feet. *Durvillea utilis* also attains a high latitude, 65° S., on the meridian of New Zealand. Its enormous fronds, sometimes ten feet long, are used by the natives of Chili to make soup, and hence its name. Equally singular is the *Lessonia fuscescens*, with its stems five to ten feet long and as thick as a man's thigh; when dried the stem contracts into a substance harder than horn, which is used by the Gauchos for knife handles. This seaweed is found only on the outskirts of the Antarctic Ocean and does not occur in high latitudes.

On the floating masses of *Macrocystis* at Kerguelen the *Challenger* naturalists found Hydroids, Holothurians, small bivalve shells, *Patella*, and Polyzoa; towards the northern limits of the Antarctic, on the way to Australia, floating pieces of *Durvillea* were met with, sometimes covered with barnacles.

Land vegetation is scarce even in the islands surrounding the Southern Ocean.

No tree grows on South Georgia or on the eastern islands—the Crozets, Kerguelen, Heard, etc.—the nearest approach to this form of vegetation being the *Phylica nitida* of Amsterdam Island. The flora of these eastern islands contains numerous representatives of the American vegetable kingdom, and also shows a connection with the New Zealand plant life. Peculiar to them is the *Pringlea antiscorbutica*, or Kerguelen cabbage. Of the Antarctic islands proper South Georgia, being in a lower latitude, contains higher forms than any other, thirteen phanerogams having been collected there. Only one of these has a brightly coloured blossom—the *Ranunculus biternatus*. Tussock grass (*Poa flabellata*) and the *Aira antarctica* have also been reported from the South Shetlands, where no other vegetation appears to grow, in spite of the subterranean heat (a minimum thermometer placed by Captain Foster on Deception Island, and brought away by Captain Smiley marked only − 5° F.). The highest latitude at which land vegetation has been found, except the lichen gathered by Mr. Borchgrevink from Cape Adare, is at Cockburn Island. Sir Joseph Hooker collected 29 species of mosses, algæ, and lichens. Of the mosses two out of five were new, and one or two of the lichens. The lichen *Lecanora miniata* gives a yellow colour to the cliffs, while the *Ulva crispa* is the only plant easily discernible on landing.

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NEW BOOKS.

Northward over the Great Ice. By Robert E. Peary. London: Methuen and Co., 1898. 2 vols. Pp. xxvi + 510 and 618. *Price* 32*s. net.*

In these two finely illustrated volumes we have for the first time a full account by Peary himself of his Arctic work. The story has already been told in part by Mrs. Peary, and by Astrüp, Peary's solitary companion in the wonderful "White March" across Greenland in 1892, but it bears retelling. Lieutenant Peary is not less successful as an author than as a lecturer, and whether he is narrating some hairbreadth escape from death at the hands of the Ice King, or the monotonous routine of Arctic life during the Great Night, the interest never flags.

Peary first visited Greenland in 1886 and penetrated over one hundred miles on to the Ice-Cap. He returned convinced of the possibility of an overland crossing, and suggested various routes, one of which was practically that taken by Nansen two years later, and another that taken by Peary himself in 1892. Official duties prevented him from prosecuting his plan, and the honour of the first crossing of Greenland fell not to him but to Nansen. This, Peary admits, was a serious blow to him, for even explorers have their little weaknesses. As soon as he was free he determined to try the more northerly route from Whale Sound to the northern terminus of Greenland, or to the intersection of the ice-cap with the east coast. The first North Greenland Expedition started in June 1891, and lasted thirteen months. The base chosen was M'Cormick Bay. The remainder of the summer was occupied with house-building, boat and sledge trips, and attempts to promote intercourse with the natives. Game proved to be abundant, and before the Great Night settled down sufficient had been killed to provide food for the winter and to furnish skins for winter and ice-cap outfits. By November 23rd there was no difference indoors between night and day, but the party was a busy one, and the darkness proved less oppressive than had been anticipated. Thanksgiving Day was celebrated on November 25th with what may fairly be described as a banquet. Nor was the party isolated. Natives frequently arrived, making their way for long distances through the Arctic night to visit the wonderful strangers. Lieutenant Peary has some racy stories to tell, especially of Eskimo love complications. The facilities thus afforded for ethnographical study were made the most of, and a large series of important photographs obtained. Snow-shoeing, ski practice, and the preparation of outfits, with anniversary celebrations, brought the party on to February. An expedition to the ice-cap to welcome the returning sun narrowly escaped ending in disaster. For forty-eight hours Peary and his companions were exposed, without shelter, to the fury of an Arctic blizzard. A few hours later they caught their first glimpse of the sun's disk. "In an instant the snow waves of the inland ice about us danced, a sea of sparkling molten gold. Neither gold, nor fame, nor aught can purchase from me the supreme memory of that moment."

At the beginning of May all was ready for the attempt on the ice-cap. The

special points in Peary's arrangements were the small size of the party, which consisted only of Astrüp and himself; the important part played by the dogs; and the lightness and strength of the sledges. Pemmican was their principal ration, and they were provided with fur clothing capable of defying cold. The travelling was done by night. The story of the journey is one of the romances of exploration. On July 4th Independence Bay was reached and named in honour of the day. More than five hundred miles had been traversed in two months. A month later Peary and his companion were back at M'Cormick Bay. The journey ranks with the famous march of Nansen and Johansen, and as a sledge journey was "unique in respect to the distance covered by two men without a *cache* from beginning to end, and in respect to the effectiveness with which these men were able to handle a large team of Eskimo dogs." It practically demonstrated the insularity of Greenland, which had hitherto been an open question.

The next North Greenland Expedition was organised in 1893. A second 1200 mile sledge journey across the ice-cap was made for the purpose of filling in the remaining gaps in the north and north-east coastline of Greenland, and of delimiting the detached lands lying north of the mainland. Severe privations were involved by the loss of all the pemmican and alcohol. Three exhausted men and nine starved dogs, ravenous with hunger, five hundred miles from their base, struggled desperately on. Had musk-oxen not appeared just as hope seemed hopeless, the little band must have left their bones to be buried beneath the snow-drifts of winter. The return journey was accomplished in twenty-five days, an average of twenty miles a day. "With a less perfect equipment than ours, with different sledges, with less experience in sledge craft, or with any severe weather or storms, our return would have been extremely doubtful."

One of the most interesting chapters in the book is the section dealing with the Smith Sound Eskimos. Peary thinks very highly of this handful of men—less than 300 souls—for whom he has done so much. He has no desire, however, to see them civilised in the ordinary sense of the word. "These people are a race of children, simple, kindly, cheerful, and hospitable. In their ingenuity, and the intelligence displayed in making use to the fullest extent of every one of the few possibilities of their country, they are, in my opinion, ahead of any other." The maps are quite unworthy of the book.

With Ski and Sledge over Arctic Glaciers. By Sir Martin Conway. London: J. M. Dent and Co., 1898. Pp. 240.

An appendix to the author's *The First Crossing of Spitsbergen*, this volume recounts the adventures of Sir Martin and a friend in exploring the interior of Spitzbergen in 1897. A map is appended of Central Spitzbergen, from sketch surveys made by the author in 1896 and 1897. To those meditating the use of *ski* (or Norwegian snowshoes), we can commend the practical remarks contained in chapter xi., in which we are informed that skiing is as easy to learn as skating, and that "the artist skister can race down steep slopes at an appalling velocity, leaping drops or crefts of almost incredible dimensions." This looks dangerous, but we are assured by the author that "downhill the real fun begins," "scorching" being quite permissible over Arctic glaciers.

Au Pays des Ba-Rotsi, Haut-Zambèze. Par Alfred Bertrand. Paris: Librairie Hachette et Cie., 1898. Pp. 331.

Captain Alfred Bertrand was one of the members of the exploring party which visited the country of the Barotse in Central Africa in 1895-6, which was organised

by Captain Gibbons, whose book, *Explorations and Hunting in Central Africa*, was reviewed in this Magazine last May. Captain Bertrand has not much to tell us about sport, and his observations of the people with whom he came in contact, although acute and interesting, have been forestalled by Captain Gibbons, and more especially by the venerable missionary Monsieur Coillard, in his well-known work, *On the Threshold of Central Africa*. Perhaps the most interesting part of Captain Bertrand's book is his descriptions of his meetings with the various branches of the French mission which have settled in Barotseland, and it is pleasant to find that he has nothing but good to say of them and their work. The volume now under review is in the form of extracts from his diary, and confirms what we already know of the difficulties and dangers of travelling in Central Africa. After his explorations in Barotseland, Captain Bertrand pushed on to Buluwayo and Johannesburg, arriving at the latter place on the eve of the famous Jameson raid. His description of the condition of Johannesburg at that time is valuable as that of a disinterested and competent eye-witness. That the town was in revolt against the authorities of the Transvaal cannot be denied, but on the other hand, there was no sign even of the turbulence and lawlessness with which we have usually to connect the idea of rebellion. On this point Captain Bertrand's testimony is conclusive. "En tout cas, les observateurs impartiaux ne peuvent pas faire autrement que de rendre justice à l'ordre parfait qui a régné dans cette ville en révolution. Les milliers de mineurs blancs et noirs qui y ont afflué à ce moment critique, sans parler des gens sans aveu, qui ne manquent jamais dans une ville de quatre-vingt mille habitants, auraient pu être à première vue un sujet d'inquiétude. Mais ils devaient savoir que toute tentative de désordre serait réprimée avec la dernière énergie par une population qui, sur ce point, n'aurait pas hésité."

Captain Bertrand visited the diamond mines at Kimberley, the tea plantations of Natal, the ostrich farms of Port Elizabeth, etc., and his descriptions are graphic and interesting. The book is furnished with two excellent maps, and the illustrations are numerous and exceptionally good.

Geographical Lectures.

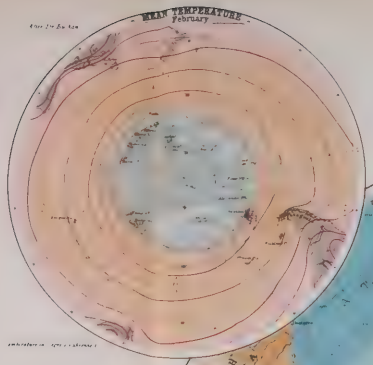
The second winter session of the School of Geography at the Outlook Tower will commence in October. Lectures on geographical subjects will be delivered by Professor Geddes, Dr. Andrew J. Herbertson, and M. Georges Guyou; and opportunities for practical work will be provided for students. Application for tickets, etc., should be made to the Assistant Secretary, Mr. Edward M'Gegan, Outlook Tower, Castlehill.

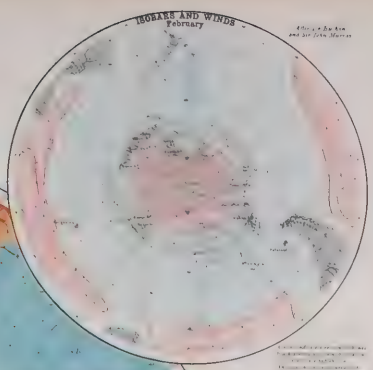
Dr. Herbertson will deliver a course of Lectures on Industrial and Commercial Geography at the Heriot-Watt College, on Wednesdays at 8.30 P.M. The first Lecture, on "The Resources of China," will be free.

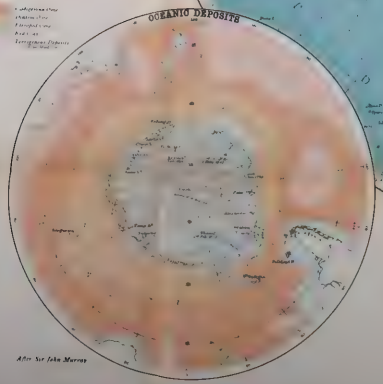
SOUTH POLAR CHART

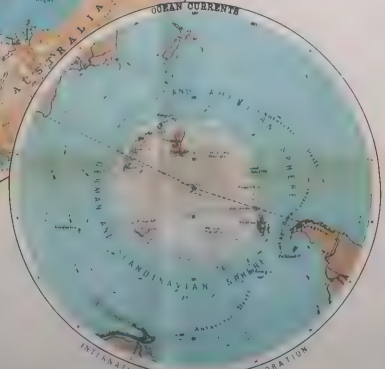
SHOWING SIR JOHN MURRAY'S PROPOSED SCHEME FOR ANTARCTIC EXPLORATION

1898









After Sir John Murray

EXPLANATORY NOTE

Ocean soundings in Fathoms
Soundings on bottom reached
Heights in English Feet
Points reached by explorers & dates

LAND COLOURING

SEA COLOURING

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION.

By Colonel George Earl Church, President of the Section.

Argentine Geography and the Ancient Pampean Sea.

Instead of addressing you upon geography as a science, or summarising the triumphs of explorers during the past year, I shall invite you to accompany me to southern South America—a step towards the Antarctic regions—and let me try to add to your knowledge of Argentine geography and the ancient Pampean Sea.

The matchless voyage of Magellan gave rise to one, in 1526, for the discovery of "the Islands of Tharsis, Ophir, and Eastern Cathay," the command of which was given by Charles v. of Spain to Sebastian Cabot, the son of John. Sebastian, *en route*, lured by silver-tongued fable, diverted the expedition, sailed for and ascended the Plata estuary and river Paraná, and attempted the conquest of the Plata valley. Disaster attended him; and, with a single ship, he returned to Spain. That valley is now being developed into a prosperous state by the application of £200,000,000 sterling of European capital—three-fourths of which is British—and is already the home of five millions of thriving, intelligent, and energetic people.

Sebastian Cabot having been brought up as a boy in this city of Bristol, I have thought it not inappropriate to this occasion to give you some idea of the land which he tried to conquer, and how nature has there marshalled her forces. She has, within easy reach, all the elements she requires for action upon the most imposing scale; and it must be admitted that she has brought them lavishly into play. The present drainage area of the Plata basin is, according to Dr. Bludau, 1,198,000

square miles, being over two and a half times that of the entire Pacific slope of the Andes. The minimum water discharge into the Plata estuary would, every twenty-four hours, make a lake one mile square and 1650 feet deep. About 64 per cent. of it would represent the flow of the Paraná, and 26 per cent. that of the Uruguay river. In my subject, the latter plays only a secondary part; the majestic Paraná and its branches assume the primary *rôle*. These interlace with the affluents of the Amazon along a line of 14 degrees of longitude. Even on the ocean I have been unable to realise vastness, as regards quantity of water, to the extent which I have while standing on the bluff overlooking the Paraná at Rosario, and also on the bank of the Amazon at Obydos. Dark, profound and mysterious, the rivers ceaselessly roll past, ever in the same direction, never to return; and, awestruck, one reflects that, for æons of ages, they have never halted in their stately march, and asks where and what is the power that gathers and lets loose these mighty floods?

Extent of the Plata Basin in Ancient Times.—I shall try to show that the Plata drainage area was, in a recent geological period, much more extensive than it is to-day; that its most northern limit was in 10° 44′ south latitude, and that nearly the entire waters which now unite to form the Madeira river, the main affluent of the Amazon, once flowed southward into a Pampean sea, which penetrated north, over the plains of the present Argentine Republic, to about 19° south latitude.

To elucidate this proposition, I must call attention to the topography of that great Bolivian basin across which the whole northern and eastern slope of the Bolivian Andes and the western slope of Brazilian Matto-Grosso send their abundant drainage to the falls of the Madeira. The present elevation of the upper fall has been found, by instrumental survey, to be 547 feet above sea-level. The distinguished engineer, Julio Pinkas, who made the survey, estimated the drainage area of the Bolivian basin at 400,000 square miles. This is somewhat in excess of, but perhaps more accurate than, my own estimate, made when I descended the Mamoré river and the Amazon in 1871. Elsewhere I have shown that the Bolivian rivers lie upon a great plateau, high above the river Purús, as well as above the lower Madeira. The Andes form the south-western and western rim of this plateau; and, between the Mayu-tata and Purús, push low hills north-east towards the falls of the Madeira. On the eastern side are the Matto-Grosso highlands, and, south-east, the low Chiquitos sierras of San Juan, the Sunsas, San Lorenzo, Ipias, Chochis, and Santiago, some of them overlooking the Argentine Gran Chaco, and having a southern drainage into the river Paraguay. The grand rim of the Bolivian basin has two breaks; one leads to the Amazon valley, by the falls of the Madeira, and the other, in longitude 62° west from Greenwich and latitude 18° south, opens into what is now known as the Plata basin. Further on, I will attempt to show how a dam was gradually thrown across this southern gap, until its elevation, once much inferior, became superior to that of the ancient lip of the falls over which the Bolivian rivers now plunge.

The mean flow of the Madeira river, at the moment of receiving its united Bolivian tributaries, is, according to Keller, 8654 cubic mètres

per second, equal to 305,616 cubic feet. Pinkas makes it 6874 cubic mètres. These must be rough calculations; for the mean flow of a river of such variable conditions could only be accurately measured by a series of observations extending over several years. I believe it is equal to that of the Paraná and Uruguay at their junction.

Outline of the Basin.—The Matto-Grosso highlands, overlooking the Bolivian basin, are composed almost wholly of red sandstone, overlying argillaceous schists; but, near the head-waters of the Gauporé river, which skirts their western base, are found rose-coloured gneiss, talc schists, and sandstones, on which frequently rest large areas of a recent alluvium, locally called *canga*.

The Chiquitos sierras rise, on an average, from 1400 to 2000 feet above the sea. (Minchin mentions a peak 3600 feet high.) I agree with Dr. J. W. Evans that, as described by D'Orbigny, they present evidences of belonging to the earlier Brazilian highlands, rather than to the younger elevation of the Andes. The western section is a wall of friable, ferruginous sandstone, sometimes flat-topped, while the extension, towards the Paraguay river, is a compact sandstone overlying talc schist, which, towards the north-east, rests on gneiss in decomposition. The San Juan and Sunsas sierras are the most northern of the Chiquitos group. The former is mostly of gneissic formation, but the latter is of sandstone resting on talc schist.

The Bolivian Andes, which face the Amazon and the Gran Chaco, are almost entirely composed of felspathic sandstones, micaceous and blue slates, clay and sandy shales, at times showing a thickness of from 10,000 to 15,000 feet. In riding from Cochabamba to Santa Cruz de la Sierra, I have especially noticed them exposed upon a gigantic scale.

The upper fall of the Madeira, called Guajará-mirim, runs over the ferruginous, conglomerate rock called *canga*. This rests on argillaceous sandstone, which crumbles easily under the action of running water. The *canga* gradually becomes undermined, and, breaking in pieces, is moved by the currents into deep water; thus the elevation of the fall is gradually lowered. Keller gives a notable example of such erosion at a point called Matucaré on the lower Madeira river. All the other barriers which form the falls are built up of varieties of granitic and metamorphic rocks.

About eighteen miles above the mouth of the Beni branch of the Madeira, and below that of the Mayu-tata, is the fall of Esperanza, having a drop of 20 feet in a length of 1000. According to M. V. Ballivian, the rock is of *canga*, the same as that of Guajará-mirim.

Pinkas found that, on the right bank of the upper Madeira river, several places are still visible where the erosive action of the waters has stripped the primitive rocks, anciently covered by a bed of ferruginous sandstone. I also saw evidences of the erosive action of the river near the upper falls, and am disposed to believe that, in the lapse of centuries, one or two rapids higher up the river have disappeared: not, however, entirely, for a reef of ferruginous conglomerate still partly crosses the Mamoré river, between the mouth of the Guaporé and the town of Exaltacion. It is probable that the western Matto-Grosso hills once extended westward to the Beni fall of Esperanza, where they met the

Andean foot-hills, and added to the height of the barrier which prevented the river system of Bolivia from breaking through to the north-east. How high that barrier may have been it is difficult to determine, owing to the country being densely forested; but in the fork of the Beni and Mamoré I found hills of perhaps 150 feet elevation above the river; and Keller mentions some on the left bank of the Beni near its mouth. The rocks of Matto-Grosso are so soft as to offer but slight obstacle to the erosive power of the mighty flood of the Madeira; and, if we admit that the lip of its upper fall, when the river began to flow over it, was only 100 feet higher than now, it will be but a small allowance in comparison to the depths which even small streams have excavated over the immense area of Matto-Grosso. The falls of the Madeira appear to have completely cleared off and exposed the granitic and metamorphic rocks upon which the Matto-Grosso shales and sandstones once rested.

Immense quantities of detritus have found their way down the Andes. The volume carried by the little river La Paz, the remotest branch of the Beni, is astounding. I once descended it to ride round the base of Mount Illimani. The river is so hemmed in between the material of the Titicaca basin and that monarch of the Andes, that I had to ford it one hundred and eight times in one day. It has cut a profound gorge through the inland range perhaps 50 feet wide and 600 feet deep. The overhanging precipices looked not over 40 feet wide at the top. Through this dark rent, which I had to penetrate or turn back, the river swept me, horse and all, as if I had been launched from a catapult.

The bed of detritus and alluvium, which the river skirts for about 50 miles, is one of the most remarkable in the world. Forbes gives it a total thickness of 2000 to 2500 feet "of alternating beds of grey, bluish, and fawn-coloured clays, gravel, and shingle beds, with boulders of clay slate, greywacké, and granite, frequently of enormous size and well rounded, as if by the action of water." In my ride down the valley, I saw nature at work tearing into this deposit, and sending it on its way to the great basin of the Beni and Mojos. During certain months, generally from November to March, a prolonged and violent local storm may arise in some lateral valley of the river. The waters then sweep impetuously down, taking with them hundreds of thousands of cubic yards of material which they pile across the La Paz river. The mass of clay and boulders rapidly becomes cemented and compacted, and holds its place until the La Paz in turn, swollen by some storm from Illimani, bursts the huge dam and hurls its contents down the valley. I noticed boulders of many tons weight at least 300 feet above the bed of the river, sticking, like half-exposed marbles, in the side of the perpendicular wall of detritus which towered high above them.

Similar denudation is going on along the entire Andean slope. The great Rio Grande carries a prodigious mass of alluvium into the gap which lies between the extreme eastern counterfort of the Andes and the Chiquitos sierras. Even its little branch, the Piray, which I descended, desolates the country far and wide, in periods of flood, with trees, sand, and mud. The Rio Grande and the Parapiti must have transported to the plain, to the east of Santa Cruz de la Sierra, millions on millions of

cubic yards of material, and have filled it to a depth of several hundred feet. The examples I have given, from personal observation, can, however, but faintly convey an idea of the grand scale upon which nature is at work tearing down the Atlantic slope of the Bolivian Andes. So far, she has succeeded in only outlining the task she has assumed; for she appears to have finished nothing. The finer touches cannot be put on with such riotous vigour.

Later, I shall show how the closing of the southern gap caused the formation of a lake in the Bolivian Mojos basin, the lacustrine character of which is not yet eliminated; for, during a period of about four months of the year, some 35,000 square miles of its surface are covered with the surplus water which cannot find exit over the falls of the Madeira, these not yet having been worn down enough to give complete drainage to the basin; or else this area is not yet sufficiently silted up to keep it out of water. Castlenau says that, "Owing to their horizontality, all the plains, from the mouth of the Mamoré to the Pilcomayo, are inundated from October to March, and present the aspect of a great ocean dotted with green islands," and, speaking of the great southern gap, says, "Across the Monte Grande a simply overturned tree would change the course of the waters." D'Orbigny is eloquent in his descriptions of the "smooth surface" and "unlimited horizon" of the vast plains of Mojos and the Beni.

Between Santa Cruz de la Sierra and the northern frontier of the Argentine Republic, the Pilcomayo river gathers its waters amidst masses of red sandstone and argillaceous schists. Farther southward, the Andes are broken into a number of secondary ridges of Palæozoic composition, among which are the sources of the Bermejo and Salado. In the most southern extension of these ridges, we find limestones and compact sandstones, mica-schist, gneiss, and granite. From about latitude 30° south, the Andes lose their great width, and thence confine themselves to the Pacific coast ridge, as far south as the Straits of Magellan. According to De Moussy, "the lower sierras, which lie to the east, present a great variety of stratified, crystalline rocks, saccharoids, slate schists, bituminous sandstone, basalts, obsidian, trachites, pumice, crystallised and amorphous quartz."

The Sierra de Cordova, extending north and south for nearly 300 miles, and having a summit about 7500 feet above ocean-level, was probably an ancient group of islands in the Pampean Sea. It consists of several parallel chains, composed principally of quartz, gneiss, and limestones of various colours. De Moussy found trachitic rocks on their northern extension, and evidences of volcanic action. South-west, and separated from the Sierra de Cordova, is the low San Luis range of gneiss and mica-schist, and sometimes crystallised quartz. Vast masses of rounded shingle, covered by a thin cap of argillaceous earth and coarse granitic sand, border the valleys. The Alto Peñasco sierra, forty miles west of the San Luis range, is also composed of crystalline rocks. The Cordon de Paramillos, near Mendoza, is of porphyry, sandstone, schists, and limestone. Here also, "immense quantities of rounded and rolled shingle cover the base of all the chains and interior valleys. The

torrents cut the accumulated *débris* to a profound depth, and expose its enormous thickness. The bottoms of the valleys are entirely composed of it."

Penetrating north of Mendoza, we find white sandstone, and mountains of red sandstone and argillaceous conglomerate in full process of decomposition. These abound, above all, in the provinces of La Rioja and Catamarca.

Southern Extremity of the Basin.—From Cape Corrientes inland, ranges of hills, irregularly massed in line, extend north-west about 150 miles. They are known as the Sierra de Tandil, and are widest at Tandil. Their greatest elevation above the sea is 1476 feet. My old friends, Heusser and Claraz, say the range is "composed of sandstone caps resting on gneissic-granite, showing the Pampean formation in the valleys and on their slopes." Sometimes the gneissic-granite shows bare, and at others elevated into sierras with slopes covered with Pampean formation.

Farther south-west, and lying between the Tandil and Bahia Blanca, are the metamorphic sierras Pillahuinco, Ventana, and Curamalan, extending west and north-west, a total length of about 100 miles, nearly to Puan. In 1859, I spent a turbulent period of several months among these mountains, as a member of a commission charged to explore the south-western frontier of Buenos Ayres, which was then being raided by the Patagonian, Araucanian, and Pampa tribes of savages. Referring to my old field-book, I find evidences that some of my notes were made in a hurry.

The greatest bulk of the Ventana range appears to be gathered near the highest peak of the Curamalan section, the elevation of which by trigonometric measurement I found to be 3363 feet above sea-level, and the Ventana peak 3563 feet. The inclination of their strata is from 60° to 85°, dipping with little variation to the north-east. On their south-west slopes, so far as we explored them, these mountains are composed of extremely hard quartz rock, white, pink, and other colours. In many places it was cut into large rhomboidal-shaped blocks.

The highly calcareous, argillaceous rock-cap of the plain, which lies between the Ventana and Bahia Blanca, slopes west-south-west, its elevation at the southern foot of the Ventana range being about 500 feet, and at Nueva Roma about 230 feet above sea-level.

Scattered over the surface of this plateau are many hollows, which, in some instances, are 100 feet below the general level. At their bottoms small lagoons are frequently found.

On the *northern* slope of the culminating peak of the Ventana, I found a conglomerate of rounded quartz pebbles, cemented by sandy, ferruginous matter. I have seen specimens of similar conglomerate from the north-west slope of the Curamalan range. I do not know the elevation of the bed which I found, but, for several reasons, believe it to be about 1200 feet above sea-level. It was, in great part, cemented to the quartz rock of the mountain, although masses of it, cubic yards in volume, had broken down or become displaced. Darwin states that, from 300 to 400 feet above the plain on the *south* side of the Ventana ("estimated at 840

feet elevation by some Spanish officers"), he "found a few small patches of conglomerate and breccia, firmly cemented by ferruginous matter to the abrupt and battered face of the quartz, traces being thus exhibited of ancient sea action." He thus estimates the height of that which he found on the south side of the mountain at, approximately, the same as that which I found on the north side.

Explorers differ as to the character and structure of the great belt of dunes which stretches along the coast from Cape San Antonio to Bahia Blanca. I am familiar with them for a distance of only seventy miles east of the latter place, along which extension they are massed to their greatest breadth and height. Perhaps an unpublished leaf from my note-book of 1859 will enable you to realise what they are as I saw them:—"We proceeded to explore the course of the river Mostazas among the dunes. For seven miles we forced our horses over sandhills and through marshes and lagoons, although they sunk to their knees at every step, and frequently floundered to their breasts in the burrows of the *Tuco-tuco*, the *Ctenomys magellanica*, about the size of a small rat. At last they lay down completely exhausted. Far to the east we could still distinguish lagoons, but not a break in the coastline gave indication of the outlet of the river, while all around us the bare sandhills reflected the sun with painful brilliancy. The exhausted condition of our horses obliged us to return dismounted. The dunes near the coast are composed of pure quartz sand of every colour, nearly all of it translucent. As they extend towards the interior they have a slight mixture of earth, until their inland line is found to contain a preponderance of light, pulverised soil. Gradually a scanty vegetation appears, until, bordering the fertile lands, they are covered with coarse grass and a few stunted shrubs. Viewed from the north they have an abrupt descent towards the west. Their coastline is about 110 feet high on an average; but, inland, they are of every elevation from 5 to 100 feet. The south-west gales violently agitate them, and cloud the air with their materials. Frequently, bowl-shaped excavations are found near their summits, which appear like works of art, so regularly are they scooped out by the wind, which must have been of terrific force. One of these, a detached hill of sand and dust, on the Sauce Grande river, about twelve miles from the coast, has had at least 5000 cubic yards of material thus taken out near its top. At the bottom of the excavation I found several fragments of quartz rock, like that on the southern slopes of the Sierra Ventana. In all the dunes composed of pure sand, I found by digging four inches below their surface, on their sides or summits, that the sand was quite wet. Such was the case during our stay, although a very dry season. Numberless little lagoons, from 50 to 100 feet in diameter, with bottoms of soft mud, are scattered among them, around the margins of which grow rushes, weeds, and bunches of the exquisitely beautiful pampa-grass, the *Gynerium argenteum*. Often when the ponds were nearly dry, the soft, silky flowers of the pampa-grass had covered their muddy bottoms with a white mantle. Numerous aquatic birds are to be seen swimming in the shallow water of the open ones. Sporting with each other are *nutrias* (the South American otter, the *Myopotamus coypu*), ducks, geese, black-necked

swans, water-hens and rose-coloured spoon-bills, all so tame that I could sit on horseback within 20 feet of them without disturbing the amusements. I have counted fourteen otters in a small lagoon; and, from the apparent familiarity with which they rubbed noses with the ducks, they were as much a part of the family as any of the feathered tribe. I never molest them. It would be a pity to break in upon their Arcadia."

I have lingered among the Ventana mountains and in their vicinity, as they were once lofty islands which played an important *rôle* in arresting and protecting the Pampean mud.

Eastern Boundary of the Basin.—Cuyabá, at the head of the Paraguay river, is, according to numerous observations of Clauss, only 660 feet above sea-level. The valleys around it are bounded by vertical cliffs of red sandstone overlying argillaceous shales, which easily disintegrate. The Matto-Grosso highlands, south of Cuyabá, as far as Paraguay, are practically unexplored; but I have no doubt they are of the same formation of sandstone and shales resting on metamorphic rock.

The Apa river, which is the northern boundary of Paraguay, drains a limestone district. Bourgade says "the main framework of Paraguay is a dark-red sandstone, but basaltic formations may be seen in many parts. Immense areas are covered to a considerable depth by a fertile red earth representing the decomposition of the sandstone hills."

From Asuncion, the capital of Paraguay, south-east to the Apipé rapids of the river Paraná, the Cordillera of Caa-guazu throws off a range of hills which overlook a great triangular space at the south-west corner of Paraguay, slightly elevated above the sea, and consisting of low, sandy ground and morasses, at times flooded by the Paraguay river. This district, united to that of the Yberá lagoon, in northern Corrientes, was probably the delta of the Paraná when it emptied into the ancient Pampean sea. The river is charged with but little silt in comparison to its much smaller affluent the Paraguay; but, in flood, it carries a volume of water said to be ten times that of the latter stream, and its width along the northern sandstone border of Corrientes is from three to nine miles. The alluvium from the immense area of Brazil which it drains is arrested by the rapids, reefs, and falls of its middle course, where it violently tears a deep channel through huge beds of red sandstone, to afterwards unite its yellowish waters with those of the muddy Paraguay.

Lying between the rivers Paraná and Uruguay is the Argentine Mesopotamia, the provinces of Corrientes and Entre Rios, covered with modern alluvium. The former is gently undulating, and is half-drowned in lagoons, the largest being the famous Yberá. The south and south-western part of Entre Rios is composed extensively of argillaceous earth, and the whole State is traversed by ridges of low hills running nearly north and south, the main ones never exceeding an altitude of 650 feet above sea-level. The framework of the province is of sandstone covered in some places by shell limestone, and sometimes by granular limestone. The north-eastern part is sandy with numerous hillocks of siliceous gravel. The exposed sandstone on the river Gualeguay extends north almost to the Yberá lagoon. On the left bank of the river Paraná, just south of its junction with the Paraguay, is the town of Corrientes, built

on a red sandstone bluff. The same stone shows for thirty miles down stream, where it disappears; and thence, for 240 miles, the banks sometimes rising to a height of 80 feet, and then at Goya descending almost to the river-level, are composed of sandy clay; but near Bella Vista are masses of rolled pebbles. Near the boundary line of Corrientes and Entre Rios the banks of the Paraná are very low on both sides of the river, and continue so for nearly 100 miles; but thence, southward, for 150 miles, the left bank is margined as far as Diamante by a range of hills from 125 to 160 feet high, at times boldly escarped and presenting a fine geological section. From Diamante the hills trend inland south-east about 50 miles, as far as Victoria; and they probably formed the border of an ancient channel of the river Paraná.

From Santa Fé to the head of the Plata estuary, the right bank of the Paraná shows a precipitous bluff of reddish clay, varying from 25 to 65 feet above mean-river level. It is being gradually undermined, and tumbles in great blocks into the river to add to its volume of silt.

The Uruguay river flows, almost throughout its course, over a rocky bed, mostly of red sandstone, at times very coarse, and then, again, of extremely fine composition; but below La Cruz, in Corrientes, there is much limestone, albeit the sandstone still predominates. The Uruguay is, except in flood, a clear water stream, and, even at its highest level, carries comparatively but little silt.

I have ridden over much of the Banda Oriental del Uruguay. The southern and western half lies from 150 to 300 feet above sea-level. Darwin is correct in saying: "It has a gently undulatory surface with a basis of primary rocks, and is in most parts covered up with an unstratified mass, of no great thickness, of reddish Pampean mud."

Secondary Rivers.—I refer again to the very important rivers Grande and Parapiti. Minchin says of them: "The Rio Grande drains a considerable part of south-eastern Bolivia. It has its sources among the ranges bordering the tableland, and flows for some 400 miles through a deep, narrow gorge, and reaches the plains in latitude 18° 55′. Bending north, it then describes a semicircle, and finally runs north-west to join the Mamoré. In its course across the plains, and as far north as latitude 17° 30′, the river flows through a wide sandy bed, bounded by banks from 16 to 25 feet high. The Parapiti rises at an elevation of 2030 feet in latitude 19° 59′ 18″, longitude 63° 4′. At the close of the dry season it flows 65 cubic yards per second, and is then absorbed by the sandy region of the plain. In the wet season it runs through a well-defined bed as far as latitude 19° 6′, longitude 62° 22′, and then spreads through the swampy, forest-covered plain. Its waters, again uniting, cut through the south range of Chiquitos at Quimome pass and form Lake Concepcion."

Between 20° and 30° south latitude the arid Andean slopes collect and send south-eastward, across the Gran Chaco, the waters of the three great rivers Pilcomayo, Bermejo, and Salado or Juramento. They are almost without an affluent once they leave the foot of the mountains, where they have their greatest volume. Sometimes they split into several channels, making narrow and enormous islands in the plain.

They are all very crooked, and have uncertain beds, at times changing an old course for a new one miles distant. Thus they erode and tear away great quantities of soft Pampean material, dissolve it into silt, and pour it into the Paraguay and Paraná. Pelleschi, in his admirable work on the Gran Chaco, estimates that "the soil annually subtracted from the territory of the Chaco by the Bermejo alone, equals 6,400,000 cubic yards."

The rivers Saladillo, Primero, and Segundo provide the water to meet the evaporation from the great inland lake of Porongos. The Tercero and Cuarto unite, and enter the Paraná near Rosario, with a considerable volume of water. The Quinto, with other small rivers, draining the southern spurs of the Cordoba range, are absorbed by the thirsty Pampean swamp, La Amarga.

Some of these rivers carry a large quantity of lime, and many of their westerly affluents carry so much as to have a white colour, thus accounting for the considerable number of them called "Rio Blanco."

A large river system, having many ramifications in the provinces of La Rioja, Mendoza, and San Luis, gathers into lagoons and main channels to find its way to Lake Urre Lauquen, and, in floods, to the Colorado. Physical and climatic changes, of which I shall treat, have profoundly modified this section of the Argentine Republic, and reduced the volume of its waters.

I am indebted to several of the Argentine railway companies for sections of their lines, made from instrumental surveys. From these, and from other sources, including a carefully prepared table of altitudes by the Argentine engineer, A. Schneidewind, I have had plotted the sections which accompany this Address.

Sections of the Country.—Section 1 shows a part of the coastline of the Southern Railway. It is practically a cross section of the east coast of the province of Buenos Ayres from north to south, where the lowest part of the Pampean beds slope into the ocean. It passes also near the head of Samborombon bay, which was once a great muddy estuary extending far inland, and the home of countless myriads of small crabs. The land slope of this bay so gradually merges into the ocean that, at a little distance, it is difficult to tell where the shore line meets the water. Century by century, it now slowly advances seaward.

Section 2, from Buenos Ayres to Rosario and Tucuman, shows with what regularity the country rises, from south-east to north-west, up to the outlying foothills of the Andes.

Section 3 is the first 350 kilomètres of the Neuquen extension of the Southern Railway, and shows in part the relation of the Colorado to the Rio Negro.

Section 4 is the Buenos Ayres and Pacific Railway to Villa Mercedes, and thence to Mendoza by the Argentine Great Western. Here we have a line almost on a parallel of latitude nearly to the frontier of Chile. Again we note the regular slope of the Pampa westward, until the country begins to swell into the Cordoba sierra. Thence to Mendoza it is broken.

Section 5 shows the Bahia Blanca and North Western Railway, as

far as Toay, and thence its proposed extension to Villa Mercedes. It traverses a district, the southern half of which has apparently been much troubled in former times by water, wind, and sand. From Victoria to Villa Mercedes the country assumes a more uniform slope; but, beyond that, to the north, it rapidly rises into the barren, mountainous districts of San Luis and western Cordova.

Section 6 is the Central Argentine Railway, Rosario to Cordoba. This is of interest as showing how far the uplifting of the Cordoba range extended east, and nearly divided the Pampean Sea into a great northern and southern section. In fact, this railway is the southern border of a belt of rounded-up country, extending from the Cordoba sierra to within thirty to forty miles of the river Paraná.

Section 7 is from Bahia Blanca north to Villa Maria (say 482 miles), thence to Cordoba by the Central Argentine line, thence to Tucuman by the Central Northern section of the Cordoba Central Railway, and thence to Jujuy by the Government railway—a total length, nearly south to north, of, say, 1127 miles. This section presents some notable features: between Bahia Blanca and Carhué it crosses the extreme western slope of the Curamalan sierra; thence to Villa Maria it shows an almost level stretch of pampa, the lowest part of which, near Trenque Lauquen, is only about 300 feet above sea-level. This depression is on the parallel of Samborombon Bay, down to which it gradually slopes in a distance of 300 miles. From Villa Maria to Dean Funes the line ascends the Cordoba mountains, a marked feature of which is their bold western escarpment, overlooking the profound hollow which separates them from the south-eastern spur of the Catamarca sierras. In this depression lies the Salina Grande. From Tucuman to Jujuy, near the Bolivian frontier, the country rises rapidly towards that mountain bastion which is thrown so far east from the Pacific Ocean, and which is the true heart of the Andes. During a ride from Jujuy to Potosi, I could not avoid being impressed with this mighty swelling up of the continent; and on several occasions, especially looking eastward, I was convinced that I could see the curvature of our globe.

Section 8 is the Buenos Ayres Western Railway. It stretches south-west across the heart of the true Pampean plain. The regularity of its gentle slope is remarkable.

Section 9 shows one of the lines of the Southern Railway, from Buenos Ayres to Bahia Blanca, and the gradual rise of the country south-westward, up the slope of the Curamalan mountains.

Section 10. This is of great interest. It starts at the Atlantic coast, and is roughly parallel to, and south-west and west of, the Plata estuary and Paraná river, and from 70 to 100 miles distant from them, until reaching a point about 100 miles above the mouth of the river Pilcomayo; thence to the great gap, between the Bolivian Andes and the Chiquitos sierras, and thence to the lip of the first fall of the river Madeira—a total length of about 1770 geographical miles (about 3300 kilomètres). This line, from the great gap to the Atlantic coast, was approximately that of least resistance to the flow of the Pampean mud. I have called attention to the very gradual north-eastern slope of the

Cordoba sierra. This section clearly shows it, and indicates, moreover, that the Salado, or Juramento, river flows along its lowest margin, and serves as the boundary of the most southern part of the Gran Chaco. In fact, the Salado occupies the south-west side of a very level depression, 300 miles across, and only 240 feet above the sea, along the north-eastern edge of which runs the Bermejo. The northern undefined limit of the Gran Chaco is probably the Chiquitos sierras. From the Bermejo, northward, the section shows the slope of this Chaco district. It is the natural incline which the waters gave it as the sand was poured in from the north.

I have been obliged to estimate the height of the present water-divide between the Plata valley and the Mojos basin. For the first 240 miles north of the divide I allow a slope of 9 inches to the geographical mile, and thence down the Mamoré river to the present lip of the Madeira falls a descent of about 4 inches to the mile. Like Keller, I found the Mamoré to be a very sluggish stream, "the inclination very small." Barometric measurements I could not take, owing to the failure of some instruments and the loss of others. The height of the upper fall of the Madeira is shown to be 547 feet above the sea. It has served as my starting-point in estimating the summit of the water-divide at 817 feet. Minchin gives a few widely separated barometric measurements on his map of the neighbouring country to the east, and I judge that he makes the divide perhaps 100 feet higher than I do. I should be glad if so able an engineer would give us further information about it.

Formation of the Bed of the Pampean Sea.—A vast area of the Plata valley is covered, to a depth of from 20 to 100 feet, by a bed of reddish-yellow, semi-plastic, argillaceous earth, varying in colour, hardness, and constituent parts. It is mixed with a little sand, and has traces of titanic iron and olivine. Due probably to underground percolation from the lime-carrying rivers, it frequently merges into a marly rock full of calcareous nodules. This rock is found over immense areas of the country, and is at times apparently stratified. Great numbers of the *Callomys viscacha* burrow in families under the rocky caps which are near the surface, and thus expose them to view. "For this reason," according to Heusser and Claraz, "the Pampa Indians call the hard material 'trui-cura,' or Biscacha stone (*trui*, Biscacha; and *cura*, stone); but the country people have given it the name of *tosca*, of which the literal translation is tufa, whether it be the bed itself or the calcareous nodules contained in the clay. The Pampas are entirely without stones or pebbles. In general the Pampa clay becomes more and more sandy as one goes west. It is the same towards the south, starting from the Quequen Salado. There is much gypsum and carbonate of lime in the deposits, and much fine *débris* of a volcanic nature."

In 1859, in a small cave excavated under a *tosca* cap at Nueva Roma, north-west of Bahia Blanca, I found stalactites from 6 to 12 inches long. Pelleschi tells me that at Puan, where a small stream has cut out a bowl-shaped depression (785 feet elevation above the sea by instrumental survey), there is a cap of tosca covering the district which is well filled with shells, closely cemented, but he does not know the species; and

that, on an island in a neighbouring lagoon, excellent lime is made from a limestone rock found there.

A broad saddle of Pampean formation lies at an elevation of over 600 feet, between the Ventana and Tandil ranges. The *tosca* rock is almost everywhere *en évidence* in the sloping plain which surrounds the Ventana and Curamalan ranges, and it is extensively exposed in the banks, and at the rapids and falls in all the little streams. I have noticed that, where these run over *tosca*, it has a hardened surface for a depth of perhaps half an inch. This is due to the hydraulic properties of the rock, which have in places been found so marked, notably at Rosario, in Santa Fé, that a few years ago, Carrasco states, the beds were worked for the manufacture of hydraulic cement.

D'Orbigny, Darwin, Bravard, Sir Woodbine Parish, Weddell, Heusser and Claraz, and others, disagree as to the origin of the "Pampean mud." Darwin wisely said "it poured down from the north"; but the then paucity of geographical knowledge regarding the interior of South America did not enable him to fix its exact source and method of conveyance. Imbedded in the Pampean formation, over widely extended areas, have been found the fossil remains of the mastodon, megatherium, mylodon, and other gigantic animals, those from Rosario to the south being mixed with shells of species still living in the neighbouring seas. After the Pampean beds were formed, and their southern and eastern margin began to emerge from the waters, the ocean along the shallow coast rolled up on the gently inclined plain quantities of shells, banks of which, miles in length, may be seen to-day far inland, giving evidences, by their curvature and general appearance, of having been piled up along an ancient coastline.

Not far from Bahia Blanca I have ridden for miles along the top of one of these embankments, about 20 feet high and 100 feet wide at the base. Most of the shells had been broken by wave action, and were mixed with abundance of rounded pumice, which probably floated down the Colorado and Negro from some volcanic centre of the distant Andes.

But a portion of the Pampean formation is still submerged, for tosca rock may be found throughout the length of the Plata estuary, forming the bottom of its southern half. Thence it extends its eastern and southern margin under water along the coast of Buenos Ayres, at least as far as Bahia Blanca.

The *savants* whom I have named have presented us with abundant evidences that the whole Pampean formation was once submerged. What appears to have confused them is the finding of similar beds in widely separated localities, and at elevations varying by thousands of feet. One may believe that wherever in the immense drainage area of the ancient Plata basin the conditions of rivers, lakes, and inland seas were favourable to the distribution of silt from the mud-producing rocks which margin the entire basin in such prodigious quantities, there the "mud" should be found; and it is conceivable that even to-day, if Nature were to form a lake by throwing a permanent dam across the entrance to an extensive valley leading into that basin, the streams

entering it would there deposit Pampean mud. If this be true, there is no reason why such mud should not be found resting immediately on crystalline rocks in places. The extent of any continuous bed would alone be limited by the drainage area receiving the silt. The origin and age of a deposit wherever found, be it at sea-level or 12,000 feet above, or be it a square mile in area or 100,000 square miles, should be treated upon its individual merits. Darwin alone appears to have entertained doubts as to the contemporaneous origin of all materials similar to the Pampean beds, attributing their uniformity more to "the similarity of the rocky framework of the continent."

The Pampean Sea connected with the Atlantic Ocean between Uruguay and the Tandil sierra. It was probably about 1400 miles in length, with an average width of above 400 miles. Roughly estimated, its area must have been about 600,000 square miles—say about two-thirds the size of the Mediterranean Sea. The area of the ancient Mojos Lake was about 115,000 square miles, being seven-tenths that of the Black Sea, and exceeding that of the five "Great Lakes" of North America, which is 93,581 square miles. The relation of the Pampean Sea to the Mojos Lake was similar to that of the Mediterranean to the Black Sea. Traces of it are still observable, notably the great, low, flooded morass of Xarayes on the Upper Paraguay river, and the ancient delta of the Paraná, including the Yberá lagoon. The Salina Grande was also an arm of it—a great inland fiord. The sea, moreover, must have covered large areas of Paraguay, Corrientes, Entre Rios, and Uruguay, and, before the uplifting of the country, it extended south-west to the rivers Chadi-Leofu and the Colorado, lapping round the southern slope of the Ventana range until the curved rim, concave to the north-east, which connects this with the Sierra de Cordoba, was sufficiently elevated to completely cut off its south-western extension. This rim, for the first fifty miles, starting at the Ventana, is about 700 to 750 feet above the sea, and shows much tosca rock near the surface. It afterwards rises rapidly towards the Cordoba sierra.

The Uplifting of the Pampean Beds.—The Pampean beds were apparently laid down in shallow water. Their present irregularity and elevation may be attributed to pronounced local uplifting, followed by an extremely slow general upheaval of the Andes from west to east, which was communicated to the whole bed of the Pampean Sea, raising it ultimately to its present level. Gradually, as the Ventana, Tandil, and Cordoba sierras were lifted, the mud settled upon their slopes until they ceased to exist as lofty islands, and with their connecting-rim of high ground formed a vast breakwater against any inroad of the ocean from the south or south-west. South of latitude 30° the force which raised the Andes has not shown the same vigour which it has to the north of that parallel, where it appears to have been greater in proportion to the broadening and swelling up of the mountain masses. As a result of this, and its slope to the eastward, the northern section seems to be upheaved from the north-west, while, southward of latitude 30°, the real west-to-east action is apparent. Here the great distance of the Atlantic coast from the Andes has caused the eastern part of the

province of Buenos Ayres to be raised but little, not sufficiently to lift the Pampean beds entirely out of the sea. In the north the gradually decreasing distance between the Cordillera and the Brazilian highlands confined the force and gave the plain its maximum lift at the great gap, at about 18° latitude, where the leverage of the Andes must then have ceased, due to the fact that, at this point, they take a sharp turn to the north-west, leaving the basin of the Beni and Mojos undisturbed.

This local and general upheaval determined the course of the Paraguay, the lower Paraná, and the Plata rivers, which were naturally pushed over against the more ancient Brazilian formation. It also, as the Pampean Sea retired, caused the Pilcomayo and Bermejo to take their south-east course across the Gran Chaco and find their present outlet.

The Tandil range has brought up, to a height of 900 feet, beds identical with the tertiary deposits 100 feet below the surface at Buenos Ayres. This indicates an upheaval of 1000 feet since Tertiary times.

Lying between the Bermejo river and the Salado, say the southern third of the Gran Chaco, we appear to have an almost undisturbed part of the bottom of the ancient sea—the present boundary belt between northern and southern climatic influences.

Age of the Pampean Formation.—The United States engineers, Humphreys and Abbot, estimate the amount of silt discharged yearly by the Mississippi river to be one cubic mile in twenty-two years. Although it carries, per cubic foot of water, much more silt than the Plata, I doubt if it exceeds that of the river Madeira, which now drains the Mojos basin, and is a very turbid stream.

The mean flow of the Mississippi at New Orleans is 675,000 cubic feet per second, but its maximum at flood is about 1,000,000. The minimum flow of the Plata, past Buenos Ayres, is 534,000, the maximum 2,145,000. It may, therefore, be fairly assumed that the yearly flow of the great North American river is not superior, and may be inferior, to that of the Plata ; and if it be admitted, as I believe, that the Madeira branch of the Amazon, at the falls, annually carries an amount of water equal to that passing Buenos Ayres, it will be evident that the total cubic volume of the streams which poured into the Pampean Sea must have been equal to twice that which the modern Mississippi contributes to the Gulf of Mexico.

Estimating the Pampean mud to cover an area of 400,000 square miles, with an average thickness of fifty feet, it would represent about 4000 cubic miles of silt. The Andean and Brazilian shales and sandstones were probably disintegrated and dissolved with great rapidity when the rivers which tore them down flowed into the Pampean Sea. These streams must then have carried, one with another, a quantity of silt which, compared to that carried to-day by the Plata and Madeira rivers, may safely be estimated at three-fourths the amount per cubic foot of water now carried by the Mississippi river. Allowing for partial loss of silt in the ocean, and from other causes, this would give the Pampean formation an age of about 70,000 years.

How the Ancient Mojos Lake was Formed.—I find the *divortium aquarum* between the Mojos and Plata basin to be only about 170 feet higher than

the ancient lip of Guajará-mirim. It is easy to understand that the Rio Grande and the Parapiti have deposited there a quantity of alluvium far exceeding 170 feet in depth. The divide, prior to this and to the general uplifting movement described, could not have been more than 200 to 300 feet above sea-level, and thus much lower than even the present lip of the upper fall of the Madeira. Therefore through this southern gap the combined streams which now form the principal affluent of the river Amazon found their way. Slowly the highly charged, yellowish-brown waters sifted out and spread their heavier material over the sandy slope at the head of the Pampean Sea, leaving the fine silt in suspension to be precipitated over the submerged plains. The waters from the north were augmented in turn by the Paraguay and Paraná, the Pilcomayo, Bermejo, and Salado. From east and west numerous rivers pushed into the sea, stirring up its waters, and thus keeping the greater part of the silt in suspension to be carried far southward and deposited, principally, and in maximum thickness, over the Pampean region south of latitude 30°.

The Grande and the Parapiti entered the plain with a northern trend to contest with the great river of the north the possession of the gap. They struck it almost at a right angle, and slowly pushed their rival eastward over against the Chaco base of the Chiquitos sierras. Here the final conflict must have taken place, as the Grande and Parapiti threw their dam across the outlet of the Mojos river, thus cutting off its exit into the ancient sea. No doubt the giant stream waged fierce war for thousands of years to keep its channel open, alternately sweeping away the barrier and again yielding to the ceaseless volume of sand and clay which, visible to-day, confirms the victory of the Grande and Parapiti. The dam having finally become permanent, the formation of the ancient Mojos Lake commenced. When it reached the level of the lip of Guajará-mirim, its waters commenced to tumble over it and carve their way to the Amazon. Since then huge volumes of alluvium have poured down the northern slopes of the Bolivian Andes; the ancient lake is now almost loaded with material, but is not yet entirely obliterated. The muddy silt which covers the surface of the basin is so fine that, when an Indian goes up stream to the mountains, his friends ask him to bring back a stone that they may see what it is like.

Since forming the dam, the Rio Grande has slowly been returning westward down the counterslope which its own alluvium creates.

Slight Tidal Action of the Pampean Sea.—Off the mouth of the Rio de la Plata, the tides which flow south along the Brazilian coast meet those making north from the coast of Patagonia, counterbalance each other, and maintain the liquid mass at nearly the same level, so that the average tide at Monte Video is only about three feet. Thus the Plata river is able to pile its silt in a direct line farther seaward than either the Orinoco or the Amazon. I have shown that the Ventana range acted as a massive breakwater to the Pampean Sea, and that the Cordoba sierra almost divided this into a northern and southern half. Hence the prevailing conditions appear to have permitted but little tidal action in the great basin. Had it been otherwise, as, *à priori*, one might suppose, the

fierce contests which the tides would have waged when meeting the large rivers would have ripped up the Pampean beds and washed them into the ocean, and, in their place, we should now find nothing but a clayey, sandy, and shingle-covered waste.

In 1860 I located the Northern Railway from Buenos Ayres to San Fernando. An extremely violent "Santa Rosa gale" swept up the Plata estuary. Finding by actual measurement that when its waters drove against the outflow of the Paraná river they tore 17 feet in one day into the high tosca bluff of San Isidro, I carried the definitive location over the hill instead of round the point at river-level.

The Inter-Andean Region.—The eastern inland Cordillera of the Andes which overlooks the Gran Chaco is separated from the Pacific coast range by a desert, bare and almost waterless belt of mountainous lands, from 250 to 300 miles wide, through the heart of which I have ridden. An extraordinary parallelism exists between the numerous lines of sierras, mostly running north and south, which fill the space. Between them are deep, scooped-out depressions, sometimes containing salt lagoons. In the rare occasions of violent storms, these receive torrential streams from channels which ordinarily carry but little water, and many of which are dry for most of the year. The whole district appears to be a southern prolongation of the Titicaca basin, and possibly may have been so before the Andes reached their present elevation. As it extends southward it grows lower and less broken, and the *salinas* occupy a larger area until, to the west and north-west of the Sierra de Cordoba, they are of enormous extent; but as latitude 30° is passed, the eastern slope of the now narrow Andean chain begins to receive a sufficiently increased rainfall to supply the waters for the western system of Argentine rivers which try to find their way southward to the river Colorado, but which they only reach at rare intervals, when some exceptionally heavy storm aids their effort to satiate the sandy, thirsty desert which they traverse. This area of about 250,000 square miles (not a very comfortable country to march an army across) frequently presents evidences of marine action on a grand scale. D'Orbigny, Darwin, De Moussy, and Burmeister allude to the accumulations of rolled shingle found in the valleys and at the base of the mountains. Darwin speaks of the ocean as having "long acted at the foot of the eastern Cordillera at nearly the same level as on the basin plains of Chile, and that the origin and transport of these vast beds of pebbles is an interesting problem." Perhaps a thorough study may show that the Patagonian gravel beds—76,000 square miles in area and 50 feet average thickness—were, like the Pampean deposits, in great part derived from the north. For reasons which I shall explain, I believe that all of this terribly eroded, inter-Andean district once had an abundant rainfall, and that, after the heavy material from the mountains had been sorted out, the rivers carried to the plains, to the west of the present province of Buenos Ayres, immense quantities of sand and clay derived from the masses of gneiss, schists, sandstone, and calcareous rock through which they flowed. For this reason, to the west of the curved boundary line of the Pampean beds, between the Ventana and Cordoba sierras, the lands are dry, sandy, and uninviting.

The contour lines of the country around the lower Colorado appear to indicate that this river once emptied into a broad, shallow estuary, which penetrated inland from the present coastline about 116 miles. Over its bottom the Colorado dropped its silt, similar to the Pampean mud, but more siliceous. On what was once its northern shore, it is not surprising that Darwin should find "an accumulation of high sand dunes, ranging westward from the coast twenty miles distant," and which he believed "were formed on the shores of an estuary." It probably included the present Bahia Blanca and its coastline as far as Mount Hermoso, to the east of Punta Alta, where Darwin found so many fossil remains of gigantic mammifers. May we not suppose that these came from the north, were floated down the Colorado, and taken to this point by the northern currents which sweep along the Patagonian coast?

Climatic Influences.—It must be admitted that an ancient sea two-thirds the size of the Mediterranean, and a lake much larger than the total area of the "Great Lakes" of North America, must have profoundly affected the climatic conditions of the adjoining regions. Perhaps no part of the world presented an example where the forces of Nature had an opportunity to display their power in equal magnitude, over such a continuous area, and with such uninterrupted simplicity. To the west, the Andes served as a lofty condenser, which, for a distance of over 2500 miles, guided the cold polar currents towards the equator and safeguarded their vigour. Similarly, the Brazilian highlands largely confined them to the great valley as they swept northward to do battle, in the heart of South America, with the warm vapours generated from the Pampean Sea and ancient lake, and the steaming, tropical basin of the Amazon. The extension of the vapour belt southward towards the Atlantic Ocean carried the equatorial currents nearer to the polar ones, thus inviting frequent atmospheric disturbance and resultant storm action. As the hot, vapour-laden winds, fertile in elements of force, met the southern cold ones, a prodigious amount of heat was set free by condensation. Into the vacuum thus created the opposing currents rushed with ever-increasing rivalry, enlarging the area of mechanical action, condensation, and vacuum, and augmenting the violence of the storm-waters, which, sweeping along the mountain slopes, must have rapidly disintegrated and eroded them, and have acted as a potent agent to transport to their base much of the material from which the Pampean beds were sifted. The rainfall over the inter-Andean region must have produced many large lakes similar to Lake Titicaca, and a great river system, which, tributary to the Colorado, swelled it into a stream of the first rank, pouring into it the sand and silt which have completely filled the enormous estuary, the outline of which is still traceable.

One may believe that an increased rainfall gave a luxuriant vegetation, where herds of gigantic mammalia found feeding ground; from which, from time to time, they were swept, by storm or swollen river, into the Pampean Sea, where also they may have lost their lives in other ways, their remains being distributed over it by the currents.

To a minor degree the ancient sea and lake must have affected the inter-Andean climate, from Cuzco to the south, throughout the lacustrine

basin of Titicaca, giving it greater rainfall and fertility than it now has. Geological examinations show that Titicaca was once one of the largest lakes of the world, and that it has slowly been drying up. Does its gradual diminution date from the disappearance of the Pampean Sea and Mojos Lake?

Savage man may have lived in South America on the mountain slopes round the ancient sea. If so, he possibly hunted the mastodon, the megatherium, and numerous other members of the gigantic fauna which probably were co-existent with him. His only highway between the eastern and western halves of the continent must have crossed the elevated region at the head of the Pampean Sea, lying between 17° and 19° south latitude, which is still the only route in use for communication by land between Bolivia and Matto-Grosso.

IN THE WILDS OF VENEZUELA.

By Major Stanley Paterson, F.R.G.S.

Until some two years ago, when the political complications resulting from the intervention of the United States of America in the British Guiana boundary dispute awakened a momentary interest in the country, Venezuela was little more than a name to the general public, and few even well-instructed people could give accurate information regarding its physical features, people, government, laws, and products, or tell whether or not it had been thoroughly explored.

For many years past geographical interest has been mainly centred in African and Polar exploration, while South America, a continent teeming with natural riches, has been greatly neglected, with the result that the vast expanse of country lying between the river Orinoco and the southern boundary of Brazil, is now practically less known to science than the darkest parts of Central Africa. Since, in the earlier part of this century, Baron von Humboldt explored the Orinoco, and Sir R. Schomburgk made an unparalleled journey from British Guiana to Esmeralda, on the Orinoco, no expedition of any importance has entered the northernmost portion of this territory, nor, so far as I am aware, has any attempt been made to connect the tracks of these explorers by investigating the country lying between them.

It was only in the autumn of 1896, when chance led me to stray into this out-of-the-way corner of the globe, that I realised how utterly unknown it was, and the idea of being one of the first white men to enter it so fascinated me, that I determined, given the opportunity, to organise a small expedition for the purpose. My idea was to ascend the Cuchivero river to its source, explore the reputed wonderful mountain of Icutu, said to be sacred to the Taparito tribe, cross the Sierra Guamapi to the head-waters of the Manapiare, descending by that river and the Ventuari to San Fernando de Atabapo, and return thence by the Orinoco.

A year later the sought-for opportunity arrived; so, hastily getting the necessary kit together, I sailed for Ciudad Bolivar, the main town on the Orinoco, and the farthest point to which regular steamer traffic is available. At Bolivar, formerly called Angostura, an old Spanish-built town, the capital of Spanish Guiana, five days were requisite to complete preparations and buy barter-goods from the local traders, who, being in constant touch with the up-country Indians, know exactly what is best to take. For these Indians have their fashions like other people, and if red and white beads happen to be their correct dress for the year, blue and yellow ones are a drug in the market. Brass wire, coarse fishing-lines and hooks, and handkerchiefs, if of a good gaudy pattern, are always acceptable. Money is almost unknown.

From Bolivar we chartered a small steamer for the further journey, and after four days' thrashing against a heavy current, arrived at Caicara, a small village of about 1100 inhabitants, at the great bend of the Orinoco, and about 500 miles from its mouth. This I had selected as my base of operations.

The moment we landed our difficulties began. I had been obliged to intrust most of the arrangements at this place to a friend—a Venezuelan and a General, as most men are in that country, but first, foremost, and above all a Venezuelan.

Now Venezuelan arrangements pan out all right if one can afford to wait for a month or a year or so, but with these people "to-morrow" is always preferable to to-day, and "presently" or "a little later" is even preferable to to-morrow. Consequently we found that things that should have been settled a month before were only being thought of. The mules which were to have met us were not forthcoming, though we were solemnly assured they would arrive to-morrow, as they were only "out on the savannah." Everything that is lost or unready in Venezuela is always "just out on the savannah." Three days' bustling procured sufficient horses, mules, and donkeys for the expedition; then it was discovered that the saddles had been quite forgotten!

Next day a mixed assortment of these was collected somehow, and at three o'clock in the afternoon we were able to start on our journey to Lajitas on the Cuchivero river, where the men for the mountain work were to meet us. As the baggage donkeys could go but slowly, we rode these seventy miles by easy stages, stopping on the way at Santa Rita, Vainas, Bucaral, and Corosal, almost the only houses we encountered.

The country we passed through in the first part of the journey was absolutely flat savannah land covered with long rich grass, and broken occasionally by belts of forest, or marshes full of the useful moriche palm, from the fibre of which the natives make cordage for all purposes.

Numerous small hill ranges strewn with quaintly standing water-worn rocks and covered to the summits with dense forest, rose abruptly from the plain, whose vastness, dwarfing their height, gave them the semblance of rows of giant ant-heaps.

Roads, properly speaking, there were none: a half-obliterated trail, barely perceptible in the rank savannah grass, better marked in the marshy moriche country, and disappearing entirely amid the rocks, was

BOLIVAR.

CAICARA.

all we had to follow. Several creeks had to be swum, the baggage being carried across extempore bridges of dead trees, and the Guaniamo river had to be crossed in many successive trips of one small canoe, the horses, mules, and donkeys swimming alongside. After crossing this river we passed through more broken and hilly country as far as Lajitas, when another stretch of rich savannah land commenced and continued as far as the foothills of the Cerro Cuchivero.

Each night we slung our hammocks in some wayside *ato* or farm-house, by no means the abode of profuse luxury. The edifice usually consisted of nine or ten forked tree stems, one at either end and one in the middle to bear the ridge pole, the others equally distributed along the sides, carrying the rafter bearers. The roof, slightly thatched with leaves of the moriche or coroba palm, was rarely watertight.

In the better class *atos* one end of this shed was filled up by a small dark room built of adobe or of logs, and used as quarters for the women and children, and sometimes in farms of pretension an adobe wall about two feet high was carried round the remainder of the house, only a narrow doorway being left.

The floor was invariably of mud, and the only furniture consisted of a rickety bench and a huge water calabash set on a tripod of logs, the household goods, which were scanty, being stored on the rafters or hung round the wooden supports.

Beds are superfluous, every one in Venezuela carrying his own *chinchorro* or hammock, which on arrival at a house he immediately slings in the airiest position possible. In most of our sleeping-places there was but one room, in which cooking, eating, sleeping, and dressing the children was done, though, by the way, but little of the latter was requisite, the scantiest garments sufficing for the elder children, while the piccaninnies went about, as Hans Breitmann would say, "mit nodings on."

A dozen people sleeping in such a shed unpleasantly overcrowded it; and to add to the discomfort, all the ducks, hens, dogs, pigs, and even the donkeys and cattle, crept in at night for shelter, making sleep a matter of some difficulty.

In some of these places mosquitoes were literally in clouds, even the smoke from several greenwood fires that were kept burning night and day round the houses and cattle-pens having apparently no effect in driving them away, and, notwithstanding our indispensable mosquito-nets, sleep was frequently impossible, dozens of the wretches managing to creep through somehow, keeping us muttering and slapping all night long. At Lajitas we camped at the most southerly house in that part of Venezuela—a house belonging to a half-breed Indian called Cimforoso, who was to take charge of our canoes—and from there sent back the horses, mules, and donkeys. I took quite an affectionate farewell of my good grey horse "Guzman Blanco," named after an ex-President of the State, I presumed on account of his colour, but on inquiry was told, "No, señor, he is such a thief he eats all the other horses' corn!" Scarcely respectful to the ex-President! Of course, as usual, nothing was ready at Lajitas, and as the canoes could not well be "out on the savannah," they were

somewhere *abajo*—down the river—instead, and could not be collected, and it was only after three days' constant worry that at last we got one large canoe capable of carrying the entire party, which now consisted of Diedrich Capellen, a great lusty Norseman, my companion and general factotum; Reuben, a Trinidad negro, engaged as cook to the expedition; twelve Venezuelans headed by Juan Nuñez, with Cimforoso as chief boatman, and myself.

From the first I doubted these Venezuelans, fearing they lacked the necessary grit to face the difficulties undoubtedly before us, and after-events proved that I judged them rightly; but they had all been specially chosen for the expedition, so I could not but take them. The spare time at Lajitas we employed in surveying, to the undisguised surprise and interest of the few inhabitants, who were fully convinced that some white man's devil's-magic was being practised.

Surveying in Venezuela is not altogether unalloyed bliss. Day work has to be carried out in the full blaze of a tropical sun, which makes one's instruments almost too hot to hold, and the moment one takes advantage of the smallest spot of shade thousands of sand-flies, mosquitoes, and small stinging beetles hold an unholy orgie on every bare spot of skin, making accurate work a matter of extreme difficulty.

Sextant work by night is no less trying. First, there is the strain of keeping awake after a tiring day's work till the particular star you want has reached its meridian, or, in forest work, the one opening between the trees where it can properly be seen; then the irritation caused by clouds of mosquitoes, seemingly able to bite through the thickest clothing, and, finally, the very heavy dew that dims the lenses and horizon glass before a contact can be made, sometimes making a whole night's work quite useless. In this district the compass was quite useless for surveying purposes, the needle varying at times as much as 40°, owing to the quantity of ironstone in the rocks.

On the afternoon of the fourth day we were fairly launched on the waters of the Cuchivero, here a fast-running stream about 100 yards in width, and now entered the unknown, no white man having been farther south in this district than Lajitas, and only two having previously penetrated as far as that. What with the strong current and the frequent portages over *raudales*, or rapids, progress was lamentably slow; and though the men worked fairly well, it took us four whole days to reach the Caño Anapui, each day being marked by some dispute with the Venezuela crew.

It began with weighing out the food. We had brought with us a large supply of rice, cassava, coffee, and *tasajo*, the sun-dried beef of the country, and as we did not expect to obtain fresh supplies for at least six weeks, it was obviously necessary to carefully husband what we had; so Capellen was bidden to issue daily a certain quantity of rice or cassava and about a pound of *tasajo* to each man in the party, ourselves included. But do you think our Venezuelan friends would have this? Not a bit of it! They threw the lot on the ground and refused to touch it, saying they were accustomed to eat as much or as little as they liked and would not be fed by measure. Vainly we explained the necessity for care—

they only answered that when the food was done they would go without it; so we finally agreed to a compromise, with the result that the original allowance was seldom eaten, but double the quantity was wasted.

Our original intention was to push on up the Cuchivero as far as possible before taking to the mountains, but the men told us such wonderful stories about a bottomless lake called Laguna de la Vaca, which lay between the mountains La Tor and La Vaca, the rocks and sand round which, said they, were full of gold, that though we gave but little credence to their story, the natural cupidity of man made it impossible to leave the spot unexplored; so detaching half the party to take the canoe to the Caño Quebradaonda, the remainder started early in the morning for the promised El Dorado, taking only two days' supplies with us, as Cimforoso, who declared he had been there once before, said we could easily do the journey in that time.

We had now left the savannah country far behind and were deep in the densely forest-clad mountains of the Cerro Cuchivero, a district into which the Venezuelans rarely venture. Cimforoso and a companion, both half-breed Indians, were the only two men who had previously been so far south.

This trip was our first real experience of the difficulties of travelling through mountain forests, and it proved a fairly rough one. The loose, broken rocks hidden beneath a tangle of undergrowth made walking painful and difficult. Every few yards huge, misshapen boulders imbedded in dense thickets of prickly wild bamboos had to be overcome somehow, while from morn to night our machetes were never idle, but were hacking, hacking away at the lianas, thorn vines, palms, and other undergrowth that barred every foot of the way. Instead of one, it took us two and a half hard days' work to reach the lake, which we found to be a large weed-grown pond with the forest branches dipping deep into the still water on the near and far sides, while to right and left huge precipitous red rocks, rising sheer from the water's edge, towered hundreds of feet toward the sky. Dead silence prevailed, and not a sign of life was visible, neither bird nor insect flitting across the glassy surface of the laguna.

The men at once dispersed to hunt for gold, and soon dozens of rock specimens were piled up in front of us, but sorely disappointed were our avaricious followers when, after inspection, we threw the stones away one by one, the fancied gold being in all cases either mica or iron pyrites. They still insisted that there was plenty of gold somewhere near us, because the *pajaro minero*, or mining bird, had called loudly to us all the way up. The Venezuelans confidently believe that this little bird, who hides in the topmost branches of the trees, and utters a loud cry, translated by them into *hay oro* (there is gold), is a certain indicator of the presence of precious metal. How can one work with such children as these? for children they are, spoilt children, with no sense of responsibility or idea of discipline, and with an inherent dislike to continuous work, though, let it be said, they can work really hard on occasion.

To them life is one vast joke, a disagreeable one at times, perhaps, when food is scarce and troubles arise, but a joke nevertheless; nothing

is really serious—government, revolution, war, poverty, starvation, and even death, all have their jocular side somewhere; and though this trait makes them impossible people to work with, one cannot help liking them for it. The lower and middle classes are honest and reliable, and the *peons* are from necessity fairly good workers, but the middle-class men (of whom my crew chiefly consisted), being all owners of small *atos* or *conucos* (gardens), are too independent and too much *Caballero* to do any work that pleases them not, and frequently will nearly starve before they take the trouble to hunt a deer or go fishing. Two days' hard cutting down the Caño Quebradaonda brought us to the canoe in an utterly famished, exhausted, and generally pitiable state. We had been without food for over fifty hours, noxious insects of all descriptions had battened on our blood till our faces and hands were swollen out of all recognition, jiggers, the worst pest of South America, had burrowed under the skin of our feet, we were full as pincushions of thorns and palm spikes, and finally, our tempers were heavenly!

The navigation now became both difficult and dangerous, and on reaching the falls, a short inspection showed the impossibility of taking the canoe farther, the river having now become practically a mountain torrent. Here we halted for three days to redistribute the baggage in man-loads, taking only the absolute necessaries of life with us, as the men could carry but little in this mountainous country.

The remainder of the baggage, along with the canoe, was hidden in the forest.

Meanwhile I spent the time in climbing the adjacent mountains wherever they were bare of forest, and was well rewarded by the magnificent view that met my eye.

Away down below ran the turbulent Cuchivero, foaming white over a hundred rocks, or, mightily pent up, hurrying silently through gloomy chasms and gorges, making a silver streak amongst the forest greenery as far as the eye could reach.

To the west ran the high range of the Cerro Cuchivero, ending in the three conical hills of the Alto, decked by countless flowering trees, red, yellow, and white, the outlines of the Cerro Guamapi showing blue in the distance. Eastward rose abruptly the sombre heights of the Negro and its unnamed neighbours, while to the south, solitarily filling up the gap between these ranges, stood the main object of my hopes and ambition, the mighty Icutu—sacred mountain of the Taparitos. This curious mountain, which by my calculations is just 11,000 feet above sea-level, rises abruptly from the plateau for about 8000 feet, when some 1000 feet of the top, which is evidently of harder rock than the lower strata, curls over like the head of a fungus, or the top of what I believe is called a "cottage" loaf of bread. The Indians say no man can ascend it, and therefore the Great Spirit lives in solitary grandeur on the top. Only on one day was I able to obtain a full view of Icutu, great grey cloud-masses obscuring the summit the remainder of the time we were in the country.

We were now entering the Indian territory, and it behoved us to be careful, especially at night.

The mountains east of the river are inhabited by the tribe already

mentioned, the Taparitos, who have the reputation of being fierce and warlike, and stoutly opposed to any violation of their territory.

On the other bank are the Panares, a tribe generally peaceful, but treacherous and thieving. Some of these men managed to creep into camp one night while the watchman slept, but were luckily frightened out before they got any booty. Both these tribes are nomadic, living beneath rocks or trees according to circumstances, and moving about after their food, which consists chiefly of parrots and monkeys.

The day after we left the Raudal Alto these Indians began to show on the hill-tops round us, in continually increasing numbers according to the men, who, sharper-sighted or more timorous than we, saw Indians where Capellen and I could distinguish nothing but forest.

Already our men were grumbling audibly because of the terribly hard work and the scarcity of food—the meat had long ago given out—and when on the third morning they began to talk amongst themselves of our all being killed and eaten by the Indians, we began to fear trouble was brewing. However, all went well till after breakfast, when they rose in a body and refused to advance a step farther.

Persuasion, arguments, and threats were alike useless, and finally the whole Venezuelan party marched off homewards, leaving Capellen, Reuben, and myself sitting on the rocks. These two faithful ones were ordered to follow the runaways in order to see that our stores at the Alto were not tampered with; but they, probably divining my intention of going on alone and trusting to luck and the Indians, only moved away a couple of hundred yards and then lay down behind the rocks to watch me. Consequently, I had hardly started on my solitary march when, hearing much puffing and panting behind me, I turned round to find them following. Under these circumstances further progress was impossible—the Indians, who hate a black man, would probably have killed Reuben at once—so, making the nearest track to the river and following its course, we cut our way back to the old camp at the Alto.

Sore though I even now feel at the desertion of the men, I do not altogether blame them, as I lay the entire responsibility on Nuñez, whom they were all afraid to oppose. But for him I am certain that the *peons* and possibly some of the better-class men of the party would have accompanied me through anything, though it must be said their hearts were not in the work, and they regarded the whole journey as a picnic to be continued only so long as it amused them.

More prisoner than master I was taken back to Lajitas, where we again camped close to Cimforoso's hut, and much to the men's surprise discharged them all without paying them a cent on account of their broken contract. They soon found a means of retaliation. Nuñez, it appears, was *Jefe civil*, or civil magistrate of the district, and his word was law, so we immediately found a strict boycott established against us. Not a soul would sell us provisions, nor could we get a single donkey or canoe to transport our baggage. After this had continued for three days one of our late canoe men crept into camp, and, professing great sympathy with our plight, said he had arranged for a canoe and four men to take us to Caicara for $120. As this was just five times the proper cost

we politely declined the offer, and our friend left, apparently somewhat disconcerted. Next night another man crept into camp and excitedly informed us that information had been sworn before Nuñez that we were in reality dangerous revolutionaries who had been carrying arms up country, and that soldiers had been sent for to put us in prison.

Another hint about the canoe followed this news, but we failed to rise to it. The following morning a deputation of three arrived with a message from Nuñez that the soldiers were now on their way, and that unless we were clear of the district within twenty-four hours, we should be committed to prison. A reply to the effect that this was the one thing of all others we most ardently desired, as the only means of recouping ourselves through the Venezuelan Government, seemed to frighten them, for, although we heard various murmurings regarding soldiers and prisons in the next few days, no further steps were taken to actively coerce us.

We were determined not to give in to their exorbitant demands, so finding something must be done to get out of this *impasse*, on the eighth night Reuben and I swam the river together—no pleasurable job considering the number of crocodiles, electric eels, and carib fish that are in it—borrowed a small canoe that we found lying some distance down the far bank, paddled it back to camp, loaded the baggage, and next morning before the Venezuelans were astir were peacefully floating down stream in the frail craft, which was terribly overloaded and leaked like a sieve. That evening we reached the small farm of Laguna Susia, finding the owner much perturbed about his wife, who had been lying dangerously ill for a month past at a house some four miles distant, as he had no one to tell him what ailed her or to give her any medicine.

Walking out to the house with him, Burroughs and Welcome case in hand, I did my best for the old lady, who was simply dying of neglect, and for this small service the old man was so grateful that on my explaining our difficulty anent the canoe he at once gave us his own large one, with three men to work it, and undertook to return the borrowed one to its rightful owners.

The remainder of the journey to Caicara was tedious and uneventful. We succeeded in shooting some deer, pig, and ducks, so, for the first time for weeks, food was plentiful.

On arrival at Caicara, finding that the time at our disposal was too limited to attempt reaching the Sierra Guamapi by way of the river Suapure, I determined on a small expedition up the Tortuga river to the country of the Colorado Indians, a semi-civilised tribe living beyond the Serrania Cerbatana, for the double purpose of discovering whether the country was easier to travel through in that direction, and also whether the Colorados would be useful men to employ on a future occasion.

This time I succeeded in obtaining three men of a very different type from the last—regular Orinoco boatmen, excellent hardy fellows, ready to do anything in their own line, though they expressly stipulated against being obliged to carry loads through the forest.

The current was so strong that in spite of a strong wind behind, it took us four days to reach the mouth of the Tortuga, which we found to be a narrow, shallow stream, more of a creek than a river.

At this time of year it was so dry that after three days' paddling we could no longer float the canoe, so had to take to the forest, here entirely composed of ironwood trees—most uninteresting but comparatively easy to walk through. Two days' march brought us to the rocky mountain forest of the Cerbatana, and this proving too much for our boatmen we leisurely retraced our steps to Caicara. Close to the mouth of the Tortuga we discovered the remains of an ancient Indian village, which had evidently been built out on piles over the river, the dry bed of which was strewn with fragments of broken pottery, most of them marked with curious Runic-looking designs. As the Indian tribes in this district have quite lost the art of making pottery, it is probable that these fragments were of considerable age.

During this journey we had plenty of shooting, deer, pig, water-hog, geese, ducks, wild turkey, turtles, crocodiles, and snakes keeping us busy with gun and rifle all day.

We also saw two magnificent jaguars, but unfortunately failed to get a shot at either of them.

Three days after our arrival at Caicara we were lucky enough to find a steamer going to Trinidad, and with our embarkation on her ended my wanderings in the wilds of Venezuela.

THE BRITISH ASSOCIATION AT BRISTOL, 1898.

THE Geographical Section, which assembled in the music hall of the Blind Asylum, under the presidency of Colonel George Earl Church,[1] F.R.G.S., held its first meeting on Thursday the 8th September. The President's address on "Argentine Geography and the Ancient Pampean Sea," which was of remarkable interest, and was delivered to a large audience, appears in this number of our *Magazine*. After a vote of thanks to Colonel Church, proposed by General Sir Charles Wilson and seconded by Dr. Scott Keltie, Mr. Vaughan Cornish read a paper on "Waves." Its author is engaged upon an investigation of the phenomena of waves so far as they come within the scope of physical geography, and exhibited to the Section a well-executed and most interesting series of lantern slides illustrating various branches of the subject, including ocean waves, breakers, the tidal bore, ship waves, waves of rivers, the rippling of sand by wind, sand dunes, ripple mark and ripple drift, wave

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[1] The other officials of the Section were :—

Vice-Presidents.

Col. F. Bailey, Sec. R.S.G.S.	B. Leigh Smith.
Professor Boyd Dawkins, F.R.S.	F. F. Tuckett.
Colonel J. Farquharson, C.B.	General Sir Charles W. Wilson, K.C.B.,
J. Scott Keltie, LL.D., Sec. R.G.S.	F.R.S.

Secretaries.

H. N. Dickson, F.R.G.S. H. R. Mill, D.Sc., F.R.G.S. (*Recorder*).
H. C. Trapnell, LL.B.

clouds and rock waves. He compared the results of his observations by means of tables showing the speed of the wind and of the resulting waves, with their mean height and length, and their slope, or the proportion existing between these two dimensions. He demonstrated the similarity in form of water-waves and sand-waves.

Mr. E. G. Ravenstein then submitted the seventh report of his committee on the Climatology of Africa, which led to some discussion on the difficulty of keeping scientific instruments in working order under the climatic and other conditions prevailing in tropical Africa; and Mr. H. N. Dickson followed with his paper on "The Temperature and Salinity of the Surface Waters of the North Atlantic during 1895-96." His paper described the first results of observations of surface temperature, made in the North Atlantic during the two complete years 1895 and 1896, by the captains and officers of merchant ships. At the request of the author the captains of a number of the vessels also collected daily samples of surface water, and the densities of these, numbering about 5000 in all, have been determined by chlorine titration. The material has been found sufficient to allow of the construction of a series of synoptic charts showing the distribution of temperature and salinity over a large part of the area during each of the twenty-four consecutive months. The series, which is the first of its kind, shows the progressive changes and provides the data necessary for extending the work recently done in and around the North Sea, in connection with sea-fisheries and long-period weather-forecasting. Specimens of the maps were shown on the screen. It is much to be regretted that, in spite of aid afforded by foreign Governments, the collection of samples was restricted by want of the funds required to pay for the carriage of the cases containing them. The last paper read on Thursday was one on the "Oceanographical Results of the Austro-Hungarian Deep-Sea Expeditions, 1890-96," by Dr. K. Natterer, of the Vienna University, a grandson of the distinguished explorer of the same name who travelled in Brazil during the early part of the century. His paper will be published in the *Magazine*.

In opening the proceedings on Friday, 9th September, the President announced that a letter had been received by Dr. Scott Keltie from Mr. Walter Wellman, stating that he had reached Cape Tegetthoff in Franz Josef Land, that his expedition was about to proceed northwards to Crown-Prince Rudolf Land, where it would winter, and that in the spring they would start towards the Pole, sending their ship back to Norway.

The first paper read was a most interesting one by Dr. J. W. Gregory, entitled "Theories on the Distribution of Oceans and Continents"; a brief summary of the paper is here given:—

The main object of geomorphology is to explain the existing distribution of land and water on the globe. A remarkable series of coincidences in the form and arrangement of the land masses suggests that the distribution has been determined by some general principle and not by local accidents. The three most striking features that require explanation are the antipodal position of oceans and continents, the triangular shape of the geographical units, and the excess of water in

the southern hemisphere. Attempts to explain this arrangement have been made deductively from general physical considerations, as by Elie de Beaumont, Lowthian Green, and G. H. Darwin; and directly from the evidence of stratigraphical geology, as by Suess, Lapworth, and Michel-Lévy. Thus Elie de Beaumont regarded the form of the continents as determined by the mountain chains, which he correlated into a regular geometrical network: while Lapworth regarded the distribution of land and water as due to a series of great earth-folds, the arches forming the continents, and the troughs forming the ocean basins. Suess has treated the subject synthetically; he has shown that the structure of the world can be explained by subsidences in the crust when subterranean support is removed by the shrinkage of the internal nucleus, and by the movements of elevation which produce the chains of fold-mountains. Suess's view explains the structure of the continents and ocean basins, but not their arrangement. To settle this problem fuller knowledge is needed as to the distribution of land and water in past times. Neumayr's attempt to settle this question for the Jurassic was premature, and his conclusions are untenable. We are thus still dependent upon the deductive systems for suggestions as to the most profitable lines of research. Elie de Beaumont's famous scheme attached undue importance to linear symmetry and was too artificial. It led, however, to the tetrahedral theory of Lowthian Green, which regards the world, not as shaped like a simple tetrahedron, but as a spheroid slightly flattened on four faces. Such flattenings occur on hollow, spherical shells, when they are deformed by uniformly distributed external pressure. The oceans would occupy the four depressions thus produced, and the land masses occur at the angles and along the edges. The existing geographical arrangement is in general agreement with this scheme; for as the tetrahedron is hemihedral, the assumption that the lithosphere is tetrahedral explains the antipodal position of land and water, the excess of water in the southern hemisphere, and the southward tapering of the land masses. The main lines of the existing system of fold-mountains have a general agreement with the arrangement of the edges of a tetrahedron. Some striking deviations occur, but are explicable by the variations in the composition of the lithosphere, and the existence of impassive blocks of old strata which have moulded the latter movements. The lines of the old fold-mountains of the Hercynian system may have been tetrahedrally arranged, with the axes occupying different positions from those of the great Cainozoic mountain system. So far, however, there is no completely satisfactory theory of geomorphology, for which we must wait for further information as to the distribution of land and water in successive epochs of the world's history. For the historical method promises more reliable results than the deductive method.

Mr. R. D. Oldham followed with a paper on "The Great Assam Earthquake of June 12, 1897."

The earthquake of June 12, 1897, in India was the largest and, with a few possible exceptions, the most violent of which there is any record. The area over which the shock was sensible was not less than 1,750,000 square miles, while the focus occupied an area of 200 miles in length and 50 miles in width. The area affected was indicated on a diagram.

Landslips on an unprecedented scale were produced in the Garo and Khasia hills, and in the Himalayas north of Lower Assam. A number of lakes have been produced by changes of level due to the earth-movements by which the earthquake was caused, and the mountain peaks have been moved both vertically and horizontally. Monuments of solid stone and forest trees have been broken across by

the violence of the shaking they have received. Communications of all kinds were interrupted; bridges were overthrown, displaced, and in some cases thrust bodily upwards to a height of as much as 20 feet, while the rails on the railways were twisted and bent. Earth fissures were formed over an area larger than the United Kingdom, and sand rents, from which sand and water were forced in solid streams to a height of 3 to 5 feet above the ground, were opened in incalculable numbers.

The loss of life was comparatively small, owing to the time of day at which the earthquake occurred—five o'clock in the afternoon—and the damage done was reduced by the fact that there are no large cities within the area of maximum violence; but in extent and capacity of destruction, as distinguished from destruction actually accomplished, this earthquake surpasses any of which there is historical record, not even excepting the great earthquake of Lisbon in 1755.

The effect of the earthquake on buildings, railways, rivers, etc., was illustrated by a series of lantern slides.

Professor J. Milne then delivered an address on "Earthquake Study." He gave an account of some of the principal seismic observatories, and showed photographic slides representing them with the instruments they contain. He urged the importance of studying earthquakes with a view to mitigation of the damage they cause on land, and also under the sea by the breakage of telegraphic cables; and he acknowledged the assistance in this direction afforded by the Foreign and Colonial Offices.

Mrs. Bishop then read a paper on "The Valley of the Yangtze."

The authoress recently travelled for eight months in the Yangtze Valley, making a journey of 1200 miles by land in the Province of Sze-chuan, and nearly 2000 by water, from Cheng-tu to Shanghai, during the land journey travelling up the smaller and western branch of the Min to its source at an altitude of nearly 1100 feet, near the Tsu-kuh-shan Pass. In the opening of the paper she briefly traced the course of the Yangtze from the sea near Shanghai to its source on the confines of the Tibetan Steppes, pointing out the magnitude and utility of the affluents which it receives after its entrance into Sze-chuan, and the access given by these waterways into the very centre of the interior. Taking the Yangtze Valley in its full geographical sense, the region watered by the great river and its affluents, as extending westwards for about 3000 miles, and into the very heart of Asia, Mrs. Bishop pointed out that this region must be taken as including the Provinces of Kiang-su, Ngan-hwei, Hu-pei, Ho-nan, Hu-nan, Kwei-chau, Kiang-si, Sze-chuan, Che-kiang, and parts of Yunnan, Kan-su, and Shen-si, making altogether the most accessible, the richest, and the most productive portion of the Empire, with an industrious and thrifty population of from 150,000,000 to 180,000,000. After briefly alluding to the treaty ports and the great cities of the Lower Yangtze, she entered more into detail regarding the country above Ichang, the head of steam navigation, and specially as to Sze-chuan, which in virtue of its area, population, and resources, she considers the Empire Province of China. She described briefly the industries of the province, its superb climate, its vast wealth in coal and iron, its elaborately organised civilisation, and modes of communication, the increase in the growth and export of opium, and in the import of Indian yarn for home weaving, and expressed the opinion that the increasing scarcity of *cash*, the fall in the purchasing power of silver, the *likin*, and the neglect of our manufacturers to study the needs of the Chinese as to the width, weight, texture, and patterns of cotton cloth, limit and hamper trade far more than the lack of steam communication on the Upper Yangtze. She noticed the genius for combination which exists among the Chinese,

and stated that in Sze-chuan, with its population estimated at from fifty to seventy millions, every occupation has its guild, except trackers and water-carriers. While recognising the fact that this province is over-populated, she considers that it has an enormous amount of wealth and prosperity, and gave, among other indications of the former, the numerous fine country mansions of a leisured class, the size and architecture of the farmhouses, the handsome bridges and fine roads presented by rich men to their localities, the splendid halls erected by the guilds, the new temples, and the magnificent charities which are liberally supported in every city. Ignorance and superstition prevail, but she believes that the hostility shown to foreigners, who from having been "Sons of the Ocean" a few years ago, are now "Foreign Devils," "Child-Eaters," and worse, is instigated and fomented by the official class for easily guessed purposes of their own. She gave her own impressions of the Chinese peasantry of the Yangtze Valley, and concluded by reminding the audience that this "sphere of influence" or "interest" extends over a third of China.

The Section adjourned after hearing a graphic account by Mr. O. H. Howarth of his recent journey "Across the Sierra Madre from Mazatlan to Durango." The author's previous travels in Mexico are well known, and his address, which was illustrated by lantern slides, will appear as a paper in our *Magazine*.

On Monday, 12th September, the work of the Section opened with an interesting paper by Dr. Scott Keltie on "Political Geography."

Geography, like most other departments of science, is capable of practical applications to human affairs, and the application of the data of physical geography and anthropogeography to Communities, States, or Nations is Political Geography.

Physical conditions, such as position on the Earth's surface, determining seasons and climate, the surface characteristics of a region, such as its orography and hydrography, and the dimensions of the territory, all have direct bearings on the State. The question of boundaries and their definition is of vital importance in this respect, the natural limit of a neutral zone of desert, or at least waste land between two nations, gave way to the defined frontier, as often as not an arbitrary line not coincident with any natural feature, and of a validity depending on the general acceptation of the treaties by which it is defined.

The utilisation of natural resources and the amelioration of routes by land or water do much to develop a country, and bring out the real relation between land and people, which is the direct subject of political geography. The internal conditions of a country are to some extent responsible even for the forms of its government and its relations with other States. These are expressed peacefully mainly by international commerce, which takes place in spite of barriers both natural—such as seas, deserts, mountains—and artificial, such as Customs tariffs.

Internal development leads in certain circumstances to colonial expansion, and the relations of colonies to the mother country vary in accordance with the character of land and people. The rapid acquisition of foreign territory in recent years has given rise to certain new features of political geography the sphere of influence, the leased territory, and the military occupation being the more important of these.

This was followed by an address from Dr. H. R. Mill on "The Prospect of Antarctic Research," which was well illustrated by numerous

excellent lantern-slide maps. The Chairman intimated his intention to endeavour to induce the Government or the citizens of the United States to despatch an auxiliary expedition to the Antarctic regions.

After a paper by Sir Benjamine Stone on "The National Photographic Record," Dr. Scott Keltie read an account by Mrs. Theodore Bent—which will appear in our *Magazine*—of a journey to the Island of Sokotra. General Sir Charles Wilson then read a paper on "The Upper Nile." He dealt with the river as a great waterway, and described the people with whom we have been fighting for the last fifteen years. Referring to the projected line of telegraph to connect Cairo with the Cape, he saw no insurmountable difficulties; but he was not so sanguine with regard to a railway, as serious obstacles exist in many parts of the route, especially between the Albert Nyanza and Fashoda. The meeting adjourned after hearing M. Louis de Rougemont's paper on his life in Central Australia.

On Tuesday, 13th September, the first address on the programme was one by Sir Thomas Holdich on "Tirah." In his unavoidable absence, the paper, which was illustrated by good photographic slides, was read by Sir Charles Wilson. The following headings indicate the scope of the paper:—

How the kingdom of Afghanistan came into existence. Its unstable nature and want of national vitality. The mixed elements of which it is composed. Its position as a buffer state, and the new creation of a buffer province between Afghanistan and India.

The demarcation of the boundaries of this province, and the results. The reason for the late risings on the frontier as given by the people themselves. Geographical results. Up till the year 1897 we had a better knowledge of Afghanistan, Baluchistan, and Persia than we had of our own border.

The province of Roh and the Rohillas. Its position as a natural barrier to North-western India. The gateways through it, by which invasions have been conducted, and the conquest of India from time to time effected. Position of Tirah in this new province of Roh. Geographical description. Nature of the roads leading into Tirah, and reason for adopting the shortest line. Difficulty of passes. Description of Chagru pass and Khanki valley; of Sanpagha pass and Mashura valley; of Arhanga pass and Maidán. The richness of its soil and formation of the cultivated slopes. Terraces and houses. Population and probable fighting strength of the tribe. Conclusion—future possibilities.

Mr. C. W. Andrews then addressed the Section on the subject of his recent exploration of Christmas Island, of which he showed a good sketch-plan with cross-sections. He also exhibited a series of well-executed and most interesting views taken in the island, which were thrown on to the screen with good effect. This was followed by Mr. G. E. H. Barrett-Hamilton's "Notes on a Visit to North-eastern Kamchatka." He said that

The north-east of Kamchatka is as yet only imperfectly surveyed, much of the coastline being still represented by a dotted line on the Admiralty charts. It is very rarely visited; hence the observations made and the photographs taken during the cruise of H.M.S. *Linnet* off the coast, in August 1897, possess some interest.

They chiefly concern the island of Karaginski, situated in 59° N. and 164° E., about twenty miles off shore, and the neighbouring village of Karaga on the mainland. The mountains of this region do not probably exceed 4000 feet in height, but in August still showed patches of snow. The village of Karaga contains seventeen balagans, or wooden huts, raised on piles to a height of about ten feet from the ground, and six yurts, or wooden huts covered over with turf. The population of the village probably does not exceed thirty. The people were found to be very friendly, remarkably polite, and able to converse in Russian. Mosquitoes were a plague, and the natives wear skin gloves as a protection. Dug-out canoes are in use on the mainland, but only skin boats on the island. The islanders appeared to be very few in number, and exceedingly primitive and quaint in their ways. They dressed almost exclusively in home-made skin-clothing; the nether garments, as on the mainland, were boots and breeches in one. They keep reindeer and sledge-dogs.

Mr. G. G. Chisholm spoke on the resources of China, with special reference to its plentiful deposits of coal, iron, and other minerals, which are at present of little more than local value in consequence of deficient means of cheap carriage. He considered that as soon as modern methods of production and transport are introduced, a development of great magnitude will be brought about, which will have far-reaching effects on the commerce and industries of this country.

Professor E. Reclus then addressed the meeting on "Some Points in the Construction of Globes," and urged the importance of building a globe on the scale of $\frac{1}{500000}$, or about one inch to eight miles. He had been struck by the fact that globes, which were formerly much more used for educational purposes than they are at present, have now lost much of their relative value as aids to geographical study, because their construction has not kept pace with the progress of modern map-making. It was time to reintroduce the extensive use of globes, on which alone the features of the earth's surface can be truthfully represented.

Professor Patrick Geddes read the last paper of the day, on the subject of "The Outlook Tower," which, with its several storeys devoted to the world, Europe, the English-speaking world, Scotland, and Edinburgh, he described in some detail. The Professor's concluding remarks were as follows:—

> In such ways the methods of the Outlook Tower come to unite scientific and educational aims with practical and public interest. It seeks not only to draft and outline, but even graphically visualise, a synthesis, an encyclopædia of ordered knowledge, but similarly to outline a correspondingly detailed *Synergy* of orderly actions. Regional Survey thus passes into Regional Activity, Regional Development. Hence the geographer, whose maps have so long recorded and prepared the (*Regional*) game of war, may here increasingly look forward to no less concrete and detailed regional organisation of the productive energies and possibilities of peace. And it is only in some such concrete way as that here proposed that the present widely discussed aspirations towards checking the spread of militarism can be effectively realised, or even concretely discussed.

The last meeting of the Section was held on Wednesday morning, when Mr. H. T. Crook read a paper on "The Selection of Place-names

for Ordnance Survey Maps." His criticisms were replied to by Colonel Farquharson and Sir Charles Wilson, the present and past directors of the Survey; and Colonel Bailey explained the nature of the work undertaken by a committee of the Royal Scottish Geographical Society in connection with the revision of the ordnance map of Scotland.

Captain B. Baden-Powell addressed the section "On Balloons and Kites in Geographical Exploration." He favoured the sail and guide-rope for directing the course, and advocated Egypt as a suitable country for carrying out experiments in the use of balloons by explorers.

The last paper was by Mr. Eric Stuart Bruce on "The Use of Electric Balloon Signalling in Arctic and Antarctic Expeditions." In the course of his remarks the author described a system invented by himself, and adopted for war purposes by the British, Belgian, and Italian Governments.

After the reading of this paper the Section adjourned until the meeting of the Association at Dover, on Sept. 13th, 1899.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Annual Business Meeting

will be held in the Society's Hall, Queen Street, on Thursday, November 17th, at 3 P.M.

Lectures in November.

Mrs. Archibald Little will address the Society in Edinburgh in the Society's Hall on November 10th, at 8 P.M. Her subject will be "The Upper Yangtze and the Thibetan Border."

On November 9th Mrs. Little will address the Glasgow Branch in the hall at 207 Bath Street, at 8 o'clock.

Mr. Frederick G. Jackson, of the Jackson-Harmsworth Expedition, will read a paper, entitled "Franz Josef Land Explored," before the Dundee Branch in the Gilfillan Hall, on Wednesday, November 2nd, at 8 P.M.

On the following evening, November 3rd, he will lecture to the Aberdeen Branch in the Hall of the Christian Institute at 8 P.M.

On Wednesday, October 26th, a special meeting was held in Edinburgh, at which Colonel Sir Howard Vincent, C.B., M.P., delivered an address on 'Recent Travels in China, Russia, North Africa, and Scandinavia.' Mr. J. B. Sutherland presided, and a vote of thanks was accorded to the lecturer on the motion of Dr. George Smith.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

Temperature of the Caspian Sea.—In the *Pilot* of the Caspian compiled by Captain Pushchin, it is stated that between Tiub-Karagan and Krasnovodsk a sudden fall of temperature is frequently met with in summer near the shore, and

it would appear from the records in the *Pilot* that the summer temperature is lower on this side than in the middle of the sea or on the western side. Captain Pushchin ascribes the phenomenon to rapid evaporation and submarine currents, while G. Philipof refers it to cold springs. Being sent in 1897 to take part in an investigation of Karabugas bay, M. J. B. Spindler took the opportunity of making observations on the temperature. On a voyage between Baku and Krasnovodsk in May, he found the surface temperature 63·9° F. in the west, 64·2 in the middle of the sea, and 67·6° in the eastern part, while the salinity was 1·38 per cent., 1·42 and 1·42 respectively, with a south-east wind or calm. Again, in July, the temperatures were 75·7°, 72·9°, and 70·5°, while the corresponding salinities were 1·39, 1·43, and 1·44, with a north-west wind or calm. Thus greater salinity was associated with higher temperature in the former case, and with lower temperature in the latter. Hence M. Spindler concludes that the variation of temperature is not due to evaporation, but to the direction of the wind. Between Krasnovodsk and Karabugas he observed in May a temperature of 63·9°, and in July of 62·4, the salinity in both months being 1·43 per cent. In the former month the wind was south and west, while the observations in July were made after feeble north-west and east winds. The wind may produce the phenomenon either by sweeping the surface water away from the coast and allowing the colder water from below to well up, or by producing currents along the coast, which, diverted to the right by the rotation of the earth, make room for the colder water to take their place.

According to this theory, the temperature of the water should fall at the eastern shore during east winds, and with northern or north-western winds that give rise to currents on the water from the north, while on the western shore the effect should be produced by south-east and south winds and by western winds, the latter driving away the surface water. And these conclusions agree with the observations. In summer the prevailing wind in the Caspian basin is the north, and therefore the temperature should be lower off the eastern shore than off the western.

M. Spindler adds a few remarks on the temperature of the lower layers. The only earlier observations were those of Grimm in the southern basin, made with imperfect instruments, and his temperatures appear to be too high. M. Spindler's were made early in July in the southern basin, sixty miles from Baku. The temperature, at the surface 72·9°, sank rapidly below 10 fathoms, and below 200 was constant at 21·2°. In this bottom layer the salinity was a little greater than on the surface, but not more than at the surface off the eastern shore, where it is generally greater than in the centre and western parts. Hence there is a slight movement of water between the surface and the depths, and this explains the absence of sulphuretted hydrogen from the deep waters of the Caspian, whereas in the Black Sea, where the salinity constantly increases, the lower layers are polluted with this gas.—*Izvestiya* of the Russ. Geogr. Soc., vol. xxxiv. No 2.

Kwang-chau.—This bay, leased to France by the Franco-Chinese Convention signed in April last, lies on the east coast of the peninsula of Lei-chau, which projects from the southern coast of Kwang-tung towards Hainan. Its position renders it a convenient port both for commerce and strategical purposes. Its perimeter measures forty miles, and is formed by the coast of Kwang-tung on the north, east, and west, and by the island Tan-hai on the south. Between the island and the coast are two narrow entrances easily defended. The best, on the east, is a channel two and a half miles long, with a maximum breadth of one thousand yards. The port has a diameter of some twelve miles from east to west, and nearly as long from north to south. Any number of the largest vessels can

anchor in it. Immediately to the north of the entrance there is anchorage in eight fathoms, and in the centre the depth is ten to twelve fathoms. Seeing that at spring-tides the water rises seven to ten feet, there must be a strong current through the eastern channel, especially when the wind blows from the west and the tide is ebbing. The country around the bay is well cultivated. Rice, sweet potatoes, sugar-cane, ground nuts, manioc, millet, and a little hemp are grown. The exports are chiefly sugar, oil, pea-cakes, and the mats used by the Chinese for sails.—*A Travers le Monde*, p. 245.

Chinese Railways.—Much attention has been directed of late to Chinese railways, and a note on those open to traffic or projected is opportunely published in *A Travers le Monde*, No. 40. The first railway in China was constructed in 1873 from Shanghai to Wu-sung by a British company. The river Hoang-pu is not navigable for large vessels up to Shanghai, and it winds so considerably as to make the distance between the town and Wu-sung as much as thirteen miles, whereas the railway, following a straight course, was only six miles long. The Chinese Government, however, bought up the line and closed it to traffic; it was afterwards pulled up. At the end of last year its reconstruction by a German engineer was sanctioned by imperial edict, and the work will sortly be terminated. To Li-Hung-Chang is due the line from Tien-tsin to Shan-hai-kwan, at the eastern extremity of the Great Wall, which was opened in 1890. Trains traverse its length of 170 miles in eight hours. By a recent arrangement with the Russian Government this railway will be prolonged to Mukden, Kirin, and Vladivostok, and will join the Trans-Siberian railway. The line, seventy-nine miles long, from Tien-tsin to Pekin was opened in May 1897. On the Manchurian railway from Stretensk through Mukden and Kirin to Vladivostok, with a branch to Port Arthur, China will receive twenty per cent. of the profits, and will become proprietor of the sections within its territory at the end of thirty years. The construction of a line from Pekin to Han-kau, a river port on the Yang-tse-kiang, seems to have fallen definitely into the hands of a Franco-Belgian company. The railway will pass Pao-ting-fu, follow the main road across Pe-chi-li and, crossing the Yellow river near Ming-chi by a bridge 1400 yards long, will arrive at Ho-nan-fu; then, passing in tunnels through the mountains separating Ho-nan from Hu-pei, it will terminate at Han-kau, 800 miles from Pekin. The line must be finished in three years. The concession includes rights over the mines in the country along the route, and a secret clause, it is said, provides for the continuation of the line to Canton. A branch from Cheng-ting to the rich coalfield of Ping-ting will be constructed by the Russo-Chinese Bank.

In 1895 the Chinese Government decided on making a line from Tien-tsin along the coast to Chen-kiang-fu, to be prolonged perhaps eventually to Hang-chau. Owing to the presence of the Germans at Kiau-chou, it has been the subject of diplomatic disputes and is still in abeyance. The Shanghai, Su-chau and Nankin railway was authorised in 1896, and a British syndicate is said to have obtained a concession for the line, which is to be continued eventually from Shanghai to Hang-chau, Fu-chau, etc. The section Shan-hai-kwan to Niu-chwang was conceded to a British company, but the Russians, being now established at Port Arthur, exacted from the Chinese Government that the line should not be subject to foreign control, and consequently the question has been discussed by the British and Russian Governments. The Burma-Yunnan railway awaits the decision of the Chinese Government, which has undertaken to inquire whether the conditions of commerce justify its construction. The French line from Hanoï to Lang-son and Nacham will be prolonged across the frontier to Lang-chau, Nan-

ning-fu and Pakhoi, reducing the time of transit to Canton and Hongkong from between thirty-five and forty days to six or seven. China has also engaged to connect any lines that may be constructed in Yunnan with any French lines which may be laid between Hanoï and Lao-kai.

It is an established principle that Korean railways shall have the same gauge as the Chinese and shall be connected with the latter through Mukden. An American company obtained in 1897 a concession for a railway twenty-five miles long from Chemulpho to Seoul.

AFRICA.

M. de Bonchamps in Ethiopia.—This explorer arrived at Addis Ababa in May 1897 and left the same month for the Abyssinian frontier, which, however, he was not allowed to cross till November. Reaching the Diddessa, an affluent of the Blue Nile, he proceeded to Gore, in the north of Kaffa, and thence to Bure, near which he crossed the Baro (the Sobat of the Arabs). This river he followed, intending to march to the White Nile. The valley is broad and intersected by a number of affluents descending from the heights of the Mocha, Alga, and Saleh. The Yambos, who live in a savage state, gave a friendly welcome to the travellers. The Wanthin was crossed not far from Finkeo (Penkeo), one of the last stages of the unfortunate Bottego. At Pomole commences the vast marshy plain which extends as far as the Nile. Tall grasses and reeds cover the ground, with here and there a stunted borassus-palm or a marsh fig. Beyond the Alworu the banks of the Baro are deserted, the natives not venturing into this fever land. On December 30th the expedition reached the confluence of the Juba, a rapid and deep river not less than 160 yards broad. Below the confluence the Baro is four times its previous size. When not far from the old Egyptian post of Nasser, M. de Bonchamps considered it necessary to turn back, his men being worn out with fever and famine. He afterwards learned that several thousand Nuers were assembled at Deng, opposite Nasser, to stop him in case he tried to cross the river to the right bank. M. de Bonchamps has accomplished geographical work of great importance, for he has traced the Sobat to the point reached by Junker twenty-five years ago.—*Comptes Rendus* of the Paris Geogr. Soc., Nos. 6 and 7.

The Caravan Trade of Tripoli.—Tripoli proper, as well as the adjoining lands on the Syrtis Minor and Cyrenaica to the east, bordering the Syrtis Major, enjoy rapid communication with the chief ports of Europe. Benghazi, capital of Cyrenaica, is only 210 nautical miles from Cape Matapan, and the town of Tripoli is 240 miles from the southernmost point of Sicily. Malta, an emporium for the goods of all nations, can be reached in a steamer in fifteen hours from Tripoli, and twenty-five from Benghazi. The coastline of Tripoli, from Ras Ajir on the frontier of Tunis to the Gulf of Solum on Egyptian territory, measures about 1200 miles, and is indented by excellent natural harbours. And yet the country is closed against the introduction of a higher civilisation. In ancient times Tripoli was the seat of prosperous cities, Greek, Carthaginian, and Roman, and the Romans established their most southern post at Garama (Jerma) in Phazania (Fezzan), and vigorously protected their trade with the tribes of the interior. Much of the soil is rich and would yield a variety of valuable crops, but as long as the local government adheres to the policy of excluding foreign enterprise, there is no prospect of new branches of industry springing up.

The importance of Tripoli practically consists in its position as the chief gateway for traffic with the interior of Africa. The form of the territory, penetrating

far into the continent from its broad maritime base, peculiarly fits it for acting as a channel for this trade. The starting-points of the caravans, Tripoli, Khoms, and Benghazi, are situated 250 miles nearer to the Sudan than Oran, Algiers, Philippeville, or Tunis. Even the railways which now connect Oran and Philippeville with Ain-sefra and Biskra are not able to compete with the Tripolitan routes. Through its depôts for goods in the interior, as Ghadames, Ghat, Murzuk, Aujila, and its merchant houses familiar for centuries with the demands and taste of the Sudanese, Tripoli is more closely connected than any other North African territory with Central Africa. The oases on the way to the south, Fezzan, Jofra, Aujila, Jalo, Kufra, are so many resting-places provided by nature for the caravans.

The wide tracts between Lake Chad and the Niger; the Bornu lands, with the towns of Kuka, Mashena, and Zinder; the Hausa lands, with the towns of Kano, Katsena, Sokoto and the western Zinder, northern Adamaua, and Baghirmi south of Lake Chad; the Tuareg of the Sahara, especially the Hoggar and Asjer tribes; the Tibbus, the Asben highlands, with Tintellust and Agades; on the west the Algerian Suf and the Mzab, as well as the Tuat oasis, and, through the traffic of this oasis with Timbuktu, this city also—all are included in the commercial sphere of Tripoli. North of Lake Chad the lands of Tibesti, Borku, Kanem, and Wadai depend on Tripoli for their imports; and, since the Nile route has been closed, Darfur has drawn a large part of its supplies from Wadai.

The routes which the traffic follows are for the most part the same to-day as in past centuries, being partly determined by natural circumstances, the existence of wells and pools, the courses of streams, and security, and partly also by the conservativeness of the Arabs. The tribes also in many cases desire to maintain the routes in the old directions, because they receive payment to protect the caravans, and prescribe the road to be followed through their territory that they may hold the leaders in dependence, and constantly keep a watch on them. The most important routes are those radiating from Ghadames. Hence they run north-westwards through the Areg, the south Algerian sand-dunes, to Ouargla and the Suf; south-westwards through El Biod to Insalah, the chief of the Tuat oases, and thus to Timbuktu, or south-eastwards direct to Timbuktu by Temassinin, Amgid, the Egere plateau and Ideles; southwards by Ghat and the Air or Asben upland, by Tintellust and Agades, to Zinder, Tessaua, Kano, and Sokoto. Caravans for Tibesti and Bornu choose the road through the Hammada el Homra, or by the Jofra oasis to Murzuk, passing through many well-peopled districts and peaceful tribes, where the dealers are not exposed, as on the roads through the Tuareg country, to attack and exaction of tolls. Hence through Gatrun and the Kawar oasis to Barrua is the dangerous part of the journey, the march through waterless desert and moving sand. The hardest and longest journey is that made by the Wadai caravans. If they start from Tripoli they skirt the coast as far as Syrt, and then turn southwards to Jofra or Zella and Kufra. From Benghazi they pass through Jalo to Kufra. Of the eastern routes to Tibesti, Borku, and Wadai little is known. Only one European, Nachtigal, succeeded, in 1869, in reaching Tibesti; Vogel ventured to Wadai, and fell a victim to science; and Rohlfs had to turn back at Kufra.

The caravan trade is almost entirely in the hands of natives. There are certainly a number of Jewish and old-established European firms in Tripoli who are concerned in the despatch of caravans, but usually the importing firms intrust their goods to the Arab or Berber merchants, giving them almost unlimited credit. Chief among these merchants are the inhabitants of Ghadames and Ghat. Considering the difficulties of caravan transport, the character of the desert, the

scarcity of water, the defective political organisation, and the exactions and plundering of the inhabitants, the courage and address of those who conduct the enterprise cannot be too highly appreciated. An opportunity of exchanging the products of the chase and of their labour for weapons, implements, utensils, and ornaments is, however, a necessity to the nomads, and therefore systematic plundering is avoided as tending to crush the trade by which they profit. The tribes in which there is some degree of organisation and dependence on political and religious superiors are always disposed to afford protection in return for regular stipulated payments, while the small independent communities are content with small presents of money or goods. The risks to which the enterprise is exposed are fully compensated by the large profits, which usually amount to 100 per cent. and more.

The command of a caravan is intrusted to a leader of Arab race who is able to offer houses or landed property as a pledge for the goods consigned to him, though this guarantee is not always exacted. The business house furnishes goods, camels, and equipment. The caravan leader is not bound down by any orders; the duration of the journey, the length of stay at the trading centres, the places of sale and purchase, the choice of goods to be taken in barter, are all left to his discretion. On the return of the caravan, and after the disposal of the goods brought back, a part of the profits agreed upon beforehand is put aside to repay the cost of equipment, and the remainder is shared between the organiser of the venture and the caravan leader. Should there be a loss it is shared by both, or more frequently is borne by the organiser of the caravan. A leader who has been fortunate for a number of years is in a position to equip a caravan on his own account, though he frequently, however rich he may be, prefers to act on commission. Unavoidable loss through robbery, war, or natural forces he is, of course, not responsible for.

Honesty is the basis of the caravan trade. Faithlessness or a false return of the prices received for goods on the part of the caravan leader is a thing unknown. The slightest suspicion of his trustworthiness would ruin him, and as there is nothing like European competition in the markets of the interior, the prices vary little, and the account of one leader may be controlled by those of others.

The trade is entirely wholesale. When the caravan is sent out by a business house which has agents in the large commercial towns, the European goods are delivered to the agents on the outward journey, and the produce of the various districts received by the caravans on the return journey. Open markets for the consumer are never held by the caravans in the Sahara and its oases, and very seldom in the Sudan. The retail trade is exclusively in the hands of the agents or the dealers in the market towns.

The caravan is seldom a commercial or social unity. The train of camels despatched by a large commercial firm, or collected under the command of a leader, is almost always joined by private adventurers, who with a few camels wish to try their fortune in the Sudan under the protection of the large caravan, and by many roving individuals who hope to make a little money on the way by their services or some chance stroke of business. The arrival of a caravan is announced in the commercial centres a day or two beforehand by a man on a riding camel, so that the dealers may have time to collect their wares for barter. The size of the caravans varies considerably, according to circumstances, from under 100 camels to 1000. There are fixed rates for transport, and fresh camels can be hired at the chief centres, Ghadames, Ghat, Insalah, etc.

Purchase of goods is effected either by the payment of cash, or, more frequently, by barter. A caravan leader, having disposed of his cotton goods to a

merchant, is sent by him to a business friend to receive payment in, say, ivory. The Turkish gold lira, the silver medjidié, and the Maria Theresa thaler are current in Tripoli and the contiguous regions; the latter also in Timbuktu, Tuat, the Kano, Kuka, and Wadai markets. In the western Sudan, Timbuktu, and Kano, the *mithkal* of gold dust, worth nearly 10s. 6d., is employed in large transactions, and in the Hausa lands the cowrie, of which 12,500 to 15,000 are equivalent to a pound sterling, is used as the unit, even where the payment is made in gold dust. The Spanish *duro* is found where there is traffic with Morocco, and French gold pieces have found their way to Tuat and Timbuktu.

The caravan trade is not now as flourishing as it was some years ago. About 1885 it was seriously affected by the breeding of ostriches commenced at the Cape, and was afterwards restricted by the Mahdi outbreak, the caravan leaders not caring to venture beyond Wadai. Again, from 1894-96, the Bornu lands were entirely closed by the victories of Rabah. The chief goods brought from the interior to Tripoli are tusks, ostrich feathers, and hides. Of less importance are gold dust, indiarubber, indigo, soda, sulphur, and medicinal plants. The work of the dealers in the town of Tripoli consists largely in sorting these articles and improving their appearance—polishing the tusks and washing and beating the feathers.

The trade might be greatly stimulated by railways of no considerable length to the depôts of the interior—Ghadames, by way of Zuara, Gharian, and Murzuk, by way of Khoms, Zeliten, Misrata, and Sokna. These would be shorter than the Ouargla railway, and would penetrate farther towards the centre of Africa by nearly two degrees of latitude.—From an article by Dr. L. H. Grothe in the *Deutsche Geogr. Blätter*, Bd. xvi. Heft 2.

Reports on the Trade of Tripoli.—According to the Report of the Vice-Consul on the Trade of Tripoli for 1897 (Annual Series, No. 2048), the total number of camels which left for the interior of Africa was 2827, in different caravans, of which 310 were for Wadai, 172 for Kanem, and the remaining 2345 for Sokoto. The goods sent were estimated at £9000, £500, and £46,000 respectively. Of these, British cotton goods formed more than 50 per cent.; French, Italian, and Austrian goods coming next in importance; German goods scarcely at all. They consisted principally of cotton and woollen cloths, silk, waste silk yarn, box rings, beads, amber, paper, sugar, drugs, and tea. The produce received at Tripoli from the interior was almost entirely composed of ostrich feathers from Wadai and Kano, tanned Sudan skins from Kano, and ivory from Wadai and Kano, the estimated worth of which, in 1897, was £92,000.

According to a Supplementary Report for 1897 on the vilayet of Tripoli by the Consul-General (Annual Series, No. 2125), the caravan trade of Tripoli is divided into three parts—that to the Western Sudan, Kano, and Sokoto, which is monopolised by the Ghadamsine merchants established in Tripoli; that to Bornu, which is engaged in by the Jewish and European merchants of Tripoli; and that to Wadai, by Tripoli Arab traders.

The goods sent to the Western Sudan—Kano—consisted of red bourrettes, calicoes, white coarse paper (from Venice), waste T-cloths, long-cloths, madapollams, prints, bornous of Vienna cloth, madapollams in 8-yard pieces dyed dark and light blue, calicoes, 22 to 24 yards, dyed dark blue, Venetian beads, tangibs, twills, brocades, fancy silk pieces, needles, drugs, sateens, and rose-water.

To Bornu, they consisted of madapollams, long-cloths, calicoes, prints, twills, bornous made of Vienna cloth, silk pieces, handkerchiefs, red bourrettes, alabaster rings, rose-water, tea, sugar, Venetian beads, and amber.

To Wadai: Venetian beads, small round looking-glasses in yellow frames,

handkerchiefs, bornous of Vienna cloth, Egyptian silk pieces, alabaster rings, tea, sugar, 2-lb. calicoes, dark blue calicoes in 8 and 22 yards, madapollams, 8 yards, dyed dark and light blue, prints, calicoes 16 to 20 yards, long-cloths, dhooties, white brocades, twills, red-bordered scarves, drugs, and rose-water.

The following is the estimate of these goods, according to their country of origin :—Cotton goods from England, £27,680 ; waste silk yarn from Italy and France, £6716 ; box rings from Bohemia, £3040 ; loaf-sugar from France and Italy, £4400 ; cloth from Austria, £2210 ; paper from Italy, £1760 ; silk stuffs from France and Germany, £560 ; tea from England, £2160 ; beads from Venice, £1200, from Bohemia, £480 ; amber from Austria, £160 ; drugs, cutlery, etc., from various countries, £4400.

Ghat is the *entrepôt* between Tripoli and the Western Sudan, and forms the real point of arrival from, and departure to, Kano. Two large caravans arrive yearly at Ghat, the merchandise of which reaches Tripoli in small quantities at a time.

"No danger," says the Consul-General, "attends the passage of caravans between Tripoli and the Fezzan, Ghadames, and Ghat, the prestige of the Ottoman Government, in the absence of any material forces, being sufficient for general security. At Ghat a long stay is made, camels are exchanged, and contracts are made with the Tuaregs for the supply of camels and safe conduct at their hands through the country between Ghat and Kano. Including stoppages, the march of caravans seldom exceeds twelve miles a day, taking about eight weeks to reach Ghat from Tripoli, and ten to twelve weeks more to Kano. The monopoly of the Tripoli-Western Sudan trade enjoyed by the Ghadamsine merchants residing in the town of Tripoli is due, apart from their superior intelligence and business habits, to the geographical position of their birthplace, an oasis in Tuareg territory, giving them a knowledge of the Arabic, Hausa, and Tuareg languages, in addition to their own language, a dialect of the Berber."

In the same Report the following distances are given between the town of Tripoli and the principal towns of the vilayet ; they are calculated at twenty-five miles a day by camel march, the hour's journey by camel being calculated as five kilomètres, or 3·106 miles :—Tripoli to Murzuk, 730 miles or 29 days ; to Ghadames, 497 miles or 20 days ; to Ghat, 938 miles or 38 days ; to Ifrin, 102 miles or 4 days ; to Khoms, 68 miles or 3 days ; to Sokna, 373 miles or 15 days ; to Sebkha, 543 miles or 22 days ; to Gatrun, the extreme north and south, 869 miles or 35 days. From Syrt to Zuara, the extreme east and west points of the sea-coast, it is 422 miles or 17 days ; from Ghadames to Shati, the extreme west and east by inland route, it is 953 miles or 38 days.

The following is the approximate male adult population of some of the towns and villages which the Report cites from the *Salnamé*, or official handbook of the province for 1896 :—Tripoli city, 20,750, district 65,000 ; Gharian, 13,256 ; Zavia, 44,470 ; Zuara, 3251 ; Khoms, 5840 ; Misrata, 33,103 ; Zeliten, 30,500 ; Syrt, 2078 ; Ifrin, 6107 ; Ghadames, 2812 ; Mizda, 1820 ; Murzuk, 306 ; Ghat, 950 ; Sokna, 1420 ; Shati, 2780 ; Zella, 500 ; Wadi Gharbi, 435 ; Gatrun, 200.

The caravan trade of Wadai with Tripoli is of small importance, as the bulk of it is with Benghazi. In the Consul's Report on the Trade of Benghazi for 1893-4 (Annual Series, No. 1545) there is an itinerary of the caravan highway between that port and Abeshr, the capital of Wadai. The main points are as follows :—From Benghazi to Aujila, oasis and town, ten days of travel and two days of rest ; to Jalo, oasis and town, one day of travel and three days of rest ; to Battifal, a well, which is the last on the southern border of the Libyan desert, one day of travel and two days of rest ; to Kufra or Kebabo, twelve days of travel, three days of rest by the way, and fifteen days of rest at Kufra ; to Tukru, the first well

on the southern border of the Libyan desert, seventeen days of travel and four days of rest; to Wanyanga, three days of travel and six days of rest; to Arada, a town where all caravans stop and send a courier to Abeshr to obtain the Sultan of Wadai's permission to continue their journey, twenty-four days of travel and fourteen days of rest; to Abeshr, four days of travel. In all, there are some seventy-two days of travel and forty-nine days of rest between Benghazi and Abeshr.

According to the Consul's Report for 1897 (Annual Series, No. 2153), seventeen caravans left Benghazi for Wadai in the years 1896-7. Six of these, with 340 camels belonged to Tripoline, and nine, with 242 camels, to local merchants; while, as usual, the Mejabra (who inhabit the oases of Aujila and Jalo, and the Zewaya who inhabit the oases of Kufra) each made up a separate tribal caravan, the first of 550 camels, and the second of 100 camels.

The goods sent to Wadai and the surrounding districts of Darfur, Kanem, Baghirmi, and Dar Runga consisted of cottons from England, France, and Tripoli, 882 camel loads of 120 okes or 338⅔ lbs., estimated at £18,800; beads from Italy *viâ* Tripoli or Malta, 150 camel loads, £1200; silks from Alexandria, Tripoli, and Tunis, 50 camel loads, £7000; sugar from Alexandria and France, 120 camel loads, £480; tea from Malta and Tripoli, 30 camel loads, £500. In all, £27,980.

The produce received at Benghazi from Wadai in the year 1896 was estimated at £24,500, of which £17,000 represents ostrich feathers and £7500 ivory. In 1897 there were 22 caravans from Wadai, 20 of which belonged to private traders, with 245 camel loads of 80 okes or 226 lbs. of ivory, estimated at £12,250; 95 loads of ostrich feathers at £19,000; the Mejabra tribal caravan with 30 loads of ivory at £1500, and 16 loads of ostrich feathers at £3200; the Zewaya tribal caravan with 20 loads of ivory at £1000, and 10 loads of ostrich feathers at £2000. In all £38,950, being £14,750 of ivory and £24,200 of ostrich feathers.

Occasionally the Sultan of Wadai sends a caravan of his own with ivory and ostrich feathers, which are usually sent on to Tripoli and sold there.

The ivory that comes to Tripoli and Benghazi from Bornu (Kano) and Wadai is derived mainly from Adamaua and Dar Runga respectively. That from Bornu is invariably preferred on account of its comparative freedom from crevices, or of its having the crevices only a short way along the tusk, while that from Wadai has crevices right along the tusk, and is besides more brittle and necessitates great care in lifting and putting down. It is sent mostly to London.

Of the ostrich feathers that come from Kano and Wadai scarcely any are now sent direct to London. They are more readily disposed of in Paris, and if they do not find an easy sale there they then are forwarded to London or Berlin.

The tanned goat-skins, red and yellow, from the Western Sudan, from Kano and Sokoto, are sent to New York, the attempts of one or two firms to introduce them into England having entirely failed.

The Consul-General and the Consul in their several reports unite in saying that the bulk of the caravan trade is as good as lost to Tripoli, which cannot compete with the trade-routes up the Niger and the Binue. Will not that be the fate, too, of the caravan trade of Benghazi when a trade-route up the Nile by way of Dongola competes with it for the trade of Wadai and surrounding districts?

AMERICA.

The Rio Branco.—The Rio Branco, formed by streams that descend from the borders of Venezuela and from British Guiana, enters the Rio Negro some 160 miles from Manaos, near its confluence with the Amazon. It is described in *Deutsche Rundschau*, for March and April, by Herr Georg Hübner, who visited it

in 1895. There is no regular steamboat service up the river, but four small launches ascend it from time to time, taking goods up and towing down large boats laden with cattle for Manaos. In one of these Herr Hübner took his passage. The water of the Rio Branco is in summer very pure and clear, while that of the Rio Negro, though also clear, has a yellow tinge, and is apparently polluted with vegetable *débris*, which renders it unwholesome. The banks of the lower Rio Branco are very flat, and subject to floods in the rainy season, and even in the dry season large pools are left behind in the forest. In the damp, soft ground around grow indiarubber trees (*Siphonia elastica*) in great abundance. Little rubber, however, is collected, either because the quality is inferior to that obtained on the upper tributaries of the Amazon, or because the people find more agreeable occupation in grazing cattle on the savannahs of the upper river. The pools contain quantities of fish, among them the gigantic representative of the herring family, *Arapaima gigas*, tortoises, and manatee.

After about two days' journey, Herr Hübner first caught sight of mountains—a lofty chain with grotesque outlines and sharply pointed conical summits running parallel to the river, which was probably the Serra Tapiira, and ahead the Cara-Carahy mountains. Before reaching the latter, the boat stopped at Vista Alegre, where there is nothing but a straw hut. Here, towards the east, lie the first grassy plains, which farther up the river are of great extent and very important for grazing. It has been proposed to make a road from this point to Manaos, 425 miles, but the numerous streams, deep valleys, filled with water in the rainy season, swamps, etc. and, near Vista Alegre, the spurs of the Serra da Lua, are serious obstacles to overcome, and it is doubtful if the work will ever be accomplished. One hour's steaming higher up is Cara-Carahy, the highest point that can be reached by the launches in the dry season, and to which the cattle destined for Manaos must be brought down from above the Cachoeira Grande, which bars the way to all large vessels, and cannot be passed without danger by small craft. At high water, laden boats can pass this dangerous place by a side channel, the Cujuby, and thus the labour of portage is saved. By this passage Herr Hübner gained the upper river, though not without difficulty and danger, for the steamer was brought to a standstill by the swift current, and could be urged through the narrowest part of the channel only by the help of a rope passed round a rock and pulled by the crew. In the middle of the next night the steamer reached the foot of the Cachoeirinha (small rapids), where a broad, rocky bar crosses the bed of the stream, leaving about a quarter of the breadth of the channel free on the right side, where the water flows with great strength. Two hours farther up the steamer passed the mouth of the Mucajahy, a stream as broad as the Elbe at Dresden, but much deeper.

Dreaded as a fever haunt, this fine river has never been explored : it is supposed to rise in the Parima mountains, where also the Uraricoeira, the upper Rio Branco, originates. At a later time, Herr Hübner travelled up the Mucajahy, which makes many windings in its lower course, for six days, and then turned up its left-hand tributary, the Piau. In this country he ascended some mountains lying at a distance from the river (the Serra Sarantipiri). The left bank of the Mucajahy skirts the boundless savannah, while the right is clothed with impenetrable forest.

A short distance above the mouth of the Mucajahy the picturesque Serra Curuma, or, as the Indians call it, Araraguare, came into sight, extending up to the left bank of the Rio Branco. Its highest point, measured with an aneroid, is about 2750 feet. It is clothed with dense forest, except here and there where the flanks are steep and the bare rock, a coarse granite, comes to view. Beyond this range lies Bôa Vista, the only town on the Rio Branco. It was founded in 1882,

and now contains 250 inhabitants, all, except the traders and officials, engaged in cattle-grazing. Herr Hübner left the steamer a little farther up the river, at San Bento, where the Uraricoeira and Tacutu unite to form the Rio Branco. The savannah is here broken by trees in groups or singly, and in the swampy patches, which are numerous, and along the banks of the streams, stands the elegant *Miriti* palm (*Mauritia flexuosa*), with its light grey stem and fan-like leaves. The character of the savannah is more or less the same in other parts, except that in certain places the clumps of trees become fewer, and sometimes only stunted specimens of the *Curatella Americana* are seen, standing not higher than 16 to 20 feet and affording little shade.

Opposite San Bento stands the ruined fort of S. Joaquin. As the house outside the fort had also fallen into a bad state of repair, the commander of the garrison had moved his detachment to a spot in the savannah most easily approached from the Tacutu. Herr Hübner visited the barracks, and having searched the neighbourhood in vain for rare orchids, returned to Bôa Vista. Why a detachment of soldiers was posted in this neighbourhood was not apparent, nor could the commander explain the mystery.

AUSTRALASIA.

The Great Barrier Reef of Australia.—In April and May 1896, Professor Agassiz paid a visit to the Great Barrier reef. His observations and conclusions have now been made public in the *Bull. of the Museum of Comparative Zoology*, vol. xxviii. No. 4. The paper is illustrated by a large number of photographs, charts, and sections. The author first describes the coast of Queensland, showing that there is everywhere a series of islands rising from the continental plateau, with irregular patches of reef flats and reefs growing upon the remnants of former islands, which have been reduced to their present level by erosion and denudation, all apparently having formed a part of the eastern extension of the Australian continent. The best description hitherto given of the reef is by Jukes, who visited it in the *Fly* between 1842 and 1846. He points out how the reef follows the outline of the coast, approaching more closely to it where the shore is steep, and maintains that its formation may be accounted for by subsidence. Professor Agassiz also assumes that the Australian coast lay at one time just within the line of the present Barrier Reef, but he holds that the existing formation can be equally well explained by erosion and denudation. The theory of subsidence would entail an enormous thickness of the coral, and there is nothing to indicate that the slope of the continental plateau has been modified by the growth of coral. Indeed, the steepest slope of the continental shelf off the Australian coast lies to the south of the Great Barrier reef. Even the outer reef patches are all well within the 100 fathom line. Sections from the mainland to the line of outer barrier reef, across rocky islands and reef flats, also clearly show that only a comparatively thin sheet of coral can stretch from the outer line of inner reefs towards the mainland, and that this sheet probably does not extend beyond the lower slope of the islands; and furthermore, that the outer reef probably does not rise from a much greater depth that that at which reef-building corals can flourish.

A depression such as the Darwinian theory requires has undoubtedly taken place over the greater part of north-eastern Australia. But this depression dates back to the Cretaceous period, and it surely cannot be maintained that the corals now underlying the Great Barrier reef began to grow at the time when this depression began, and that they have a thickness corresponding to a subsidence of at least 2000 feet.

MISCELLANEOUS.

A caravan from the Sultan of Dar Runga has arrived at the Mobangi.

Major Lang, delegate of the Society to the Vasco da Gama celebration, has been made a Corresponding Member of the Lisbon Geographical Society.

An important discovery of **petroleum** has been made in the neighbourhood of Anaklia, a town near the mouth of the Ingur in the Black Sea. In consequence of the favourable report of two experts, boring will be at once commenced, and it is expected that Anaklia will successfully compete with Baku, seeing that it is a port on the Black Sea, whereas Baku is separated from Europe by the breadth of the Caucasus, some six hundred miles.—*Comptes Rendus* of the Paris Geogr. Soc., Nos. 6 and 7.

In the *Contemporary Review* for October Dr. Felkin gives his views regarding the administration of the **Sudan**. As the Arab portion has been more than decimated during the Mahdi's rule, he considers that trade and industry should be developed first in the Negro districts, and that for this end the old forts should be re-established on the White Nile, as well as Fatiko in the Shuli district, and one or two stations in the Bahr-el-Ghazal and elsewhere. The railway should be continued to Khartum, and the Suakin-Berber line laid. Eventually a light railway should be constructed from Omdurman to El Obeid, which might be continued when necessary to El Fasher, the capital of Darfur. On the White Nile steamers can ply as far as Bedden (4° 35′ 38″ N. and 31° 36′ 6″ E.), where there is a rapid half a mile long, which probably could be rendered navigable so as to throw open the section to Kiri. Thence to Dufile no steam navigation will ever be possible. From Dufile to the Albert Lake there is no hindrance to navigation at any season. The Sobat is navigable for three hundred miles during most of the year; from Lake No the Bahr-el-Ghazal and Jur are navigable for more than half the year to a point at 5° 10′ N., 28° E., and the Bahr-el-Arab to a point near the mines of Hofrah-en-Nahass. The Blue Nile is always open to steamers up to Fazokl. The *sudd* on the While Nile is not a serious obstacle, as it has blocked up the river only three times in the last thirty years, and with more frequent traffic would not be able to accumulate. The natural wealth of the Sudan is such that under proper administration it could not fail to yield a surplus revenue. A copy of a map, drawn by General Gordon, showing the boundaries of the provinces, the revenue, etc., accompanies the article.

The following notes are taken from circulars issued by the Scottish Education Department. With regard to the teaching of **Geography** in elementary schools the circular gives the following directions :—

"Whatever other subjects may be embraced in the curriculum of class instruction, candidates for the Merit Certificate should have a good *general* knowledge of the geography of the world, and of the geography of the British Isles, the Colonies, and Europe in some detail. They should also be able, if set to the study of a good map of a country or district previously unknown, to find out and report the principal particulars of the information to be gleaned from it."

For the new type of school, styled Higher Grade (Science) School, which it is proposed to establish, and to which will be admitted only such pupils as have gained the Merit Certificate, the following scheme of geographical study is set forth in the circular :—

"A revisal of previous knowledge; the reading of maps (*e.g.* of contour lines) and their construction; elementary exercises in surveying and mapping; a thorough

regional survey, by means of excursions, of the physical geography, flora, fauna, and historical antiquities of the district in which the school is situated; a study of commercial geography, based largely upon the shipping and trade news of the daily papers."

These regulations may be welcomed as showing that our educational authorities recognise the real importance of geography, and the necessity for teaching it on scientific principles.

NEW BOOKS.

Emin Pasha: his Life and Work. Compiled from his Letters, Journals, Scientific Notes, and from Official Documents, by GEORG SCHWEITZER. With an Introduction by R. W. FELKIN, M.D., F.R.S.E. With Portraits, Facsimiles, and Map. Translated from the German. Two vols., demy 8vo. Pp. 330 and Introduction, and 312 and Index. *Price* 32*s*.

This book—*Emin Pasha's Life and Work*—cannot fail to be of great interest to members of the Royal Scottish Geographical Society. It is not very long since the Council of the Society petitioned the Government of the day to send an expedition to aid Emin to hold his own in the Egyptian Equatorial province. Now, Uganda and Unyoro are under a British protectorate, and, after the lapse of twelve years of anarchy in the Sudan, the Egyptian flag once more flies at Khartoum, at Fashoda, and on the Sobat. Between then and now much has happened—Stanley's great expedition, the unlooked-for retreat of Emin from his province, his arrival on the east coast, his mysterious accident at Bagamoyo, followed by his entry into the German colonial service, a new expedition into the interior of Africa, a couple of years of scientific activity, ending with his assassination and the loss of all hope that he would give to the world the vast stores of information which he had so faithfully collected during his eventful career in Central Africa.

Although he himself has not been able to give us of the fulness of his unique knowledge, his diaries and many notebooks, filled with all kinds of scientific work, found their way to Berlin, and Mr. Georg Schweitzer, a brother-in-law of Emin's, undertook to write his life. The two volumes we now notice are a slightly abbreviated translation of this biographical work.[1]

The author has given a complete record of Emin's life—we prefer to use this name in preference to the unfamiliar, although more accurate, one of *Schnitzer*—from his school days to his tragic death at Kinena on October the 23rd, 1892. Mr. Schweitzer is a sympathetic biographer, but he does not shut his eyes to Emin's failings, and from this book we obtain a well-balanced view of a living man of remarkable parts, of noble characteristics, yet with a strange mixture of strength and weakness, which became more noticeable and even regrettable at the end of his desperate fight to retain his province from the Madhi's grasp. We cannot wonder, indeed, that *then* the flesh was weak; an heroic struggle had taken place, success seemed almost within his grasp, and then, for reasons which one can more easily surmise than definitely state, he somehow failed to lay hold of the very thing which would have realised his most ardent hopes.

Emin, who was born at Oppeln in Silesia, on the 28th of March 1840, was educated at the Catholic College in Neisse, and subsequently he studied medicine

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[1] Emin's diaries and scientific notes are, we understand, to be published in full later on.

at the Universities of Berlin, Breslau, and Königsberg. He won high praise from his teachers, and had much success in practical work as assistant to various professors. He graduated in Berlin in 1863, but he never took the State qualification which would have enabled him to practise in Germany. During his student life "he possessed certain fantastical leanings—a tendency to fluctuate between extremes—a mixture of equally groundless optimism and pessimism." Funds were low, and the roving spirit, which from the first possessed him, was strong, so we find him leaving Berlin for the south, trying for one appointment after another, until on the 21st of December 1864 he arrived on Turkish soil at Antivari, where he shortly afterwards became quarantine officer. He remained in the Turkish service till 1875, and during these eleven years was most active in his professional work, in learning many languages, for which he had a great predilection, and in writing newspaper and magazine articles, as well as studying various branches of natural science.

During his stay in Turkey he was from time to time occupied in semi-political expeditions on behalf of the Government, and doubtless his residence in that country had a great influence on his subsequent career. He paid a brief visit to his home at Neisse in 1875, but inaction was repugnant to him, and he soon left Germany for Egypt. Proceeding *viâ* Khartoum, he arrived at Lado on the 17th of April 1876, and was appointed by Gordon Pasha medical officer to his province.

From this point the real interest of the book commences, for Emin's African career now began, and we see him first as medical man, then as political agent visiting Unyoro and Uganda, then as Gordon's successor governing the Egyptian Equatorial Province. His success with the natives was strikingly apparent; and to the value of his work in all branches of science ample testimony is paid by those best qualified to judge. Learned societies were glad to enrol him as member, and his writings enriched many scientific journals; later on his work was recognised by the Royal Geographical Society, which presented him with their gold medal for geographical work.

The museums in London and Bremen, and later on in Berlin, were indebted to him for many valuable collections, and hardly an explorer in Africa can be named who has done more for the scientific exploration of the country, although others have in the nature of things done far more for geographical exploration.

Emin's work as governor of the Equatorial Province is fully sketched, and the successful efforts he made in its development are thoroughly appreciated. A concise account is given of the rise of the Madhi's rebellion and the isolation of the Equatorial Province, and Emin's troubles with the Egyptian officials and officers in the Province are dealt with at some length. The extracts from his diaries show the strain he underwent, which, however, he never allowed to interfere with his scientific observations.

The first chapter of the second volume is appropriately entitled "Under the German Flag." In it we see the effect which nationality has upon a man. Emin had been for many years cut off from all, save scientific, communication with his fatherland, and in thinking of Central African development his thoughts had turned to Great Britain and not to Germany for aid. Now, however, he sees that Germany has commenced a colonial policy, and has a sphere of influence upon the east coast of Africa. Owing to his unfortunate accident at Bagamoyo, he becomes enveloped in an exclusively German environment, and a telegram from his Kaiser completes a rapid and unexpected metamorphosis. He throws his old aspirations aside, and from being a professed Turk and high official he is contented to sink to the position of a German subordinate. The result, as might be expected,

was not entirely satisfactory, and in the chapters which detail his expedition under German auspices, and his treatment by his superiors, we see sufficient to convince us that, although he was able to do a considerable amount of useful work in founding stations and annexing territory to the German Empire, yet he was hampered on all hands, never receiving, even to the end, his official appointment from his Government. At the same time, his work of exploration and his scientific observations continued, and in this volume there is evidence enough to prove that his intellect was unclouded and his power of work undiminished, although he was suffering from partial blindness and from his prolonged residence in the tropics.

After establishing a German station on the western shores of the Victoria Nyanza, he journeyed towards the north and met many of his old soldiers, learning that his old province was in a state of anarchy. At this time smallpox broke out in his camp, and a famine occurring at the same time rendered his position most precarious. After the departure of his companion, Dr. Stuhlman, with all the able-bodied men to the coast, followed weary weeks of fighting against sickness and famine, until at length Emin was able by painful marches to reach Kinena, striving to gain the west coast. Here it was that his tragic death occurred; he was murdered by the Arab slave-dealers on the 23rd of October 1892. Such was the sad and pathetic end to a life which had been full of self-sacrifice and devoted to the interests of science and civilisation.

For many reasons this work is well worth careful perusal, the details throughout being highly interesting. We have avoided quotations and only given a very brief summary of its contents.

In conclusion we must say a few words on the Introduction by Dr. Felkin. Herr Schweitzer represents Dr. Felkin as working in the interests of British financiers to acquire possession of Equatoria, and the Introduction is written to show that Dr. Felkin's efforts were solely directed to maintaining Emin in his province under the conditions he himself desired. In a letter dated October 2nd, 1886, Emin expressed his willingness to accept the protection of England, or to make an arrangement with a syndicate of English commercial men who should appoint him their agent. Accordingly, Dr. Felkin, in 1888, made on his behalf an agreement with the Imperial British East African Company, by which the Company bound themselves to establish a government in the province and to retain Emin Pasha as governor during his life, or as long as he should think fit to hold the office. Thus Emin's independence would have been secured if he had ratified the agreement. Dr. Felkin clearly shows that support and not rescue was the aim both of himself and of this Society in its petition to Lord Iddesleigh, which is also accused by Herr Schweitzer of self-interested motives.

As a German reviewer has indicated, Emin himself would never have written parts of this book nor have sanctioned the publication of many of the statements contained in it, which are often completely erroneous and misleading.

Even had not Dr. Felkin thoroughly confuted the attack made on him, an impartial reader could not fail to be struck by the groundlessness of the repeated assertions that the aims of the promoters of the Relief Expedition were the extension of British influence and commercial advantages. The Stanley expedition is stigmatised as a "huge ivory hunt," solely because Sir F. de Winton very justly claimed that part of Emin's store of ivory, should it be recovered, should be devoted to the expenses of the expedition, which were very heavy, and to which the Egyptian Government contributed only £10,000. Again, the revolt of Emin's troops is attributed to the arrival of Stanley, whereas the immediate cause seems to have been that the despatches of the Egyptian Government were written in

French, which the officials who could not read them treated as forgeries; nor was this by any means the first exhibition of insubordination.

We cannot help saying that exceedingly bad taste is shown in the references to Mr. Stanley and his expedition, which, however much the author may have disapproved of it, was, as we know, conducted with enormous self-sacrifice and heroism.

The same spirit of jealousy of the nation that actually rescued Emin Pasha, which the German expeditions failed to do, pervades the whole work. It is quite evident that the annexation of the Egyptian province by Germany would have met with Herr Schweitzer's approval, and the suggestion that the securing of the ivory "for the Empire" was the praiseworthy object of Emin Pasha's expedition to the Albert Nyanza is amusing, especially as the boundary between the British and German spheres of influence had then been defined by treaty.

Through Asia. By Sven Hedin. London: Methuen and Co., 1898. Two vols. Pp. 1278. *Price* 36*s. net.*

Dr. Sven Hedin travelled in Central Asia from 1893 to 1897, traversing the Pamirs both in summer and winter, exploring the neighbourhood of Mustagh-ata, which he also thrice attempted to ascend, crossing the Gobi to Lop-nor, making an excursion into Tibet, and finally terminating his journey at Pekin. Some of the most striking results of his journey have been made known by his letters to the Berlin Geographical Society, and were noticed in this *Magazine*; and in December members of this Society had the pleasure of listening to the traveller's graphic account of his experiences, the most thrilling of which was the terrible passage of the Takla-Makan desert.

The present work is a popular account of his long journey, and will be especially attractive to the general reader. The scientific results will be published at some future time, when Dr. Hedin's determinations of position and elevation, meteorological observations, etc., have been reduced by the specialists who have undertaken the task. Many interesting scientific details are, however, given in this book, such as experiments to ascertain the movement of the Mustagh-ata glaciers, which is very slight, soundings in the lakes of the Pamirs and gauging of rivers, besides geographical observations on the relief of the Pamirs, the sand-dunes of the Takla-Makan, the hydrography of the central region of Asia, etc.

Among the questions he treats of is the history of Lop-nor, which, he maintains, changes its position, so that the present southern lake, Kara-Koshun, is not the lake of the ancient Chinese geographers. It may be remembered that M. Kozlof has lately opposed this view, affirming that the Kara-Koshun is the Lop-nor both of the Chinese and of Przhevalski. Dr. Hedin still adheres to his own view, and promises to discuss the question thoroughly in a subsequent work.

The author's account of the many different tribes he encountered, their customs, trade, industries, and superstitions, are very full, as during so many years he had ample opportunity of making observations. He was often thrown into close contact with the native inhabitants, and in general contrived to maintain friendly relations with them. Dr. Hedin possesses the tact and firmness so necessary in the leader of an expedition among semi-civilised tribes, and his perseverance and endurance triumphantly overcame the many difficulties experienced in frozen elevated tracts and waterless deserts. The narrative should be read by all who desire information on Central Asia and its people.

Translation is work requiring considerable judgment and a large store of knowledge of various kinds. Too frequently translations of foreign works betray a want of the necessary qualifications, but in this case the services of Mr. J. T. Bealby, who was

at one time connected with our Society, have been secured. Mr. Bealby has had considerable literary experience, and the translation, in which he was assisted by Miss E. H. Hearn, leaves nothing to be desired. The illustrations are of unusual value, having all been drawn from sketches by the author and under his direction, or reproduced directly from his photographs. Several maps are also added. Lastly, the printer's work deserves a word of praise; the type and paper are good, but the latter is, perhaps, a little too heavy.

Pioneering in Formosa. Recollections of Adventures among Mandarins, Wreckers and Head-hunting Savages. By W. A. Pickering, C.M.G. London: Hurst and Blackett, 1898. Pp. xvi + 283. *Price* 6*s.*

Among the many books that have recently appeared on the Far East, this one will easily hold its own. Its author is a man whose intimate knowledge of Chinese life and custom was gained through many remarkable experiences and not a few dangerous adventures. It is interesting to note that Mr. Pickering's career was the direct outcome of his linguistic faculty. Not only was he familiar with several important Chinese dialects, but he was also able to converse with some of the wild aboriginal tribes of Formosa. The story of his attempts to reach these, and of his ultimate comparative success, is well told, and touches on many interesting phases of savage life. But perhaps the most thrilling part of the narrative is the account of his struggles with the wily corrupt Chinese official. Simply but graphically he tells adventures, which only a man of singular intrepidity and alertness in emergencies could have passed through scatheless. On one occasion he was all but entrapped by a pleasant-spoken mandarin to what would almost certainly have been his death. It was only the fear of "Pi-ki-lien's" dreaded seven-shooter which enabled him to rush the ambuscade that had been prepared for him. One particularly amusing episode was the manner in which he conquered the marked hostility of a festival crowd by springing on the stage of the theatre and striking up a strathspey on his Scottish bagpipes, while his companions danced to the measure. These personal adventures give a thrilling interest to a book which is otherwise full of valuable information both geographical and ethnographical. In the preface the author laments that Great Britain did not take possession of Formosa, as we might easily have done several times since 1860, but admits that, ourselves excluded, the island could not be in better hands than the Japanese. In an appendix Mr. Pickering reproduces various letters by himself and articles by interviewers all bearing on the present aspect of the Far Eastern Question. In these, as in the preface, he, like others who have lived their life in the East, grieves over the supineness of our successive Governments and the extraordinary credulity they have so often displayed in dealing with the astute but wholly unscrupulous Chinaman. From a purely scientific point of view we have seen nothing calling for criticism save the curious statement that the "rapid encroachment of the land upon the sea is due to several causes, principally to the extraordinary violence of the typhoons which occur during the south-west monsoon." The argument is that the heavy rainfalls and swollen torrents bring down "an enormous amount of sediment to the seashore, where the violence of the south-west winds prevents this accumulation from being carried out to the sea, thus forming a great delta upon the western coast." This is true enough, no doubt, but it hardly warrants the statement that the *typhoons* cause the land to encroach upon the sea. The facts mentioned by Mr. Pickering point strongly to a gradual and fairly rapid elevation of the land, a phenomenon familiar to all who have studied geology. Twenty-five illustrations from photographs and sketches by the author add to the attractiveness of the book, which by a happy

mingling of description and adventure gives a more vivid picture of Chinese life and character than will be found in many a more pretentious work.

Wanderings in Burma. By GEORGE W. BIRD (Educational Department, Burma). With Illustrations and Maps. Bournemouth: F. J. Bright and Son, 1897. Pp. iv + 410. *Price 21s. net.*

The title of this book leads one to expect a narrative of travel; it is found on perusal to be a combination of gazetteer and guide-book, in which the personal element is almost entirely wanting. It is a large work, printed in type pleasing to the eye, and handsomely got up (though too many misprints have been allowed to remain in the text); it is illustrated by a large number of maps, plans and tables, and many fine reproductions of photographs; and it may be described as a compilation containing information on nearly every point regarding Burma on which the home-keeping and the travelling Briton alike could desire it. The introduction, which occupies rather more than a third of the book, is a miscellany of facts geographical, ethnological, zoological, religious, historical, etc., drawn from various sources, chiefly official: the remaining two-thirds are devoted to a detailed description of twenty-four routes of travel in this recently acquired dependency of the British Empire. In regard to the introduction, some readers will feel that the languages and dialects of Burma receive too scanty treatment as compared with several matters of less general interest; while, in regard to the second part, which is a guide-book pure and simple, the author has compiled such a mass of facts, and gone into such detail, that the size of the resultant volume is likely to be against its use as a guide for travellers in the interior. "Those intending to go off the beaten track," writes Mr. Bird, "are advised to take little beyond what is absolutely necessary with them, and to compress their luggage within as narrow limits as possible." A book that weighs nearly 4 lbs., in spite of its real value as a guide, would be an encumbrance to one who must travel light. Still, to intending travellers it will be found of great service in showing what is to be seen in Burma, and how best to see it.

The author's spelling of native names raises the vexed question as to the transliteration of Oriental languages. The system he adopts differs from that in some of the accompanying maps, and in some cases (perhaps due to oversight in proof-reading) he vacillates between two spellings of the same word. It is high time that some influential body in this country adopted, and recommended for general adoption, a uniform system of transliteration, as the absence of system leaves readers in doubt, when perusing works of this kind, how the native names and words are pronounced. Mr. Bird omits to give a phonetic key to his system.

The book is, however, a valuable compendium, and will doubtless be freely used as a work of reference. Its editor has had twenty years' experience of the country he describes, and being in a position to command the best and fullest information on all matters connected with the recent history and present condition of Burma, he may be accepted as a competent authority upon the subject.

History of Australia. By G. W. RUSDEN. Second Edition. In 3 vols. Melbourne and London: Melville, Mullen, and Slade, 1897. Pp. 625, 688, and 521 + xcii.

In these three volumes, containing the leading annals of Australia, the author exhibits considerable skill in marshalling his facts, and has evidently spared no pains to verify them. He even assists in rescuing from misstatement the illustrious authority of Captain Cook when "some sceptics went so far as to contend at great length that Cook did not name Botany Bay, Port Jackson, or New South Wales." So ignorant was the Government of New South Wales of the origin of the name of

its own colony, that in 1893 it sanctioned the publication of *Historical Records* asserting that "there is no foundation for the popular impression that Cook bestowed the name New South Wales on the territory," an assertion disproved that very year by the publication of Cook's own journal by the Hydrographer of the Admiralty, Captain Wharton. In that journal, under date 22nd August 1770, Cook wrote, "In the name of his Majesty King George the Third, I took possession of the whole Eastern Coast (from latitude 37° down to this place) by the name of New South Wales."

No sooner was Arthur Phillip appointed first governor of New South Wales by the influence of Lord Sydney (whose name is perpetuated in its capital) than exploration and annexation commenced. In 1788 Phillip traced the Hawkesbury river from its mouth to Richmond Hill, and in 1790 he discovered and named the Nepean river. Next year Captain Vancouver found and named King George's Sound. In 1793 Captain W. Paterson, Lieutenant-Governor of New South Wales, named the Grose river after Major Grose, who had misgoverned the colony before him. In 1795 C. Grimes, the colony's surveyor, explored Port Stephens, "taking with him Wilson, the convict, who could converse with the natives." Next year George Bass, Surgeon H.M.S. *Reliance*, ascended the highest of the Blue mountains, whilst Lieutenant Shortland, when searching for runaway convicts, discovered the Hunter river, naming it after the Governor. In 1798 Surgeon Bass and Lieutenant Flinders (also of the *Reliance*) sailed across the Straits now called Bass Straits, and reaching Van Diemen's Land (now called Tasmania), entered the river Tamar, and named Port Dalrymple. Four years later whilst Baudin, the commander of a French expedition, was sailing fruitlessly along the shores of the colony now known as Victoria, John Murray, commanding the British Government's brig *Lady Nelson*, discovered Port Phillip (named after Arthur Phillip), and hoisted his Britannic Majesty's colours on shore after a sharp conflict with the natives.

There is, to Scotsmen, an interesting passage in this work describing the arrival at Sydney, New South Wales, in 1794, of "convicts called the Scotch Martyrs." These were Muir, Palmer, Margarot, and Skirving, to whom a monument in the Calton Cemetery (not, as printed, at "Carlton Hill"), Edinburgh, was erected in 1844 by "the friends of Parliamentary Reform." Mr. Rusden maintains that these "Scotch Martyrs" were most disloyal Britons, and would have welcomed Bonaparte had he invaded Britain as a Republican General. However gratifying it may be to find a colonist like Mr. Rusden so loyally devoted to the mother country, it is but justice to the "Martyrs" to say that that eminent Scottish judge Lord Cockburn, entirely acquits them of disloyalty in his work entitled *An Examination of the Trials for Sedition which have hitherto occurred in Scotland* (2 vols., Edinburgh, D. Douglas, 1888). Lord Cockburn arrives at the conclusion that the "Martyrs" were only enthusiasts who anticipated the Reform Bill which Parliament passed thirty-eight years later. According to his Lordship, all they really wanted was a reform of the Parliamentary representation, but, by their foolish mimicry of "the outside of the French National Convention," they terrified the authorities, and suffered accordingly.

Th. Thoroddsen. *Geschichte der Isländischen Geographie. Vorstellungen von Island und seiner Natur und Untersuchungen darüber in alter und neuer Zeit.* Autorisierte Uebersetzung von AUGUST GEBHARDT. Zweiter Band: Die isländische Geographie vom Beginne des 17. bis zur Mitte des 18. Jahrhunderts. Leipzig: B. G. Teubner, 1898. Pp. xvi + 383. *Price* 12 *M.*

The second volume of this important work fully realises the expectations raised by the publication of the first, which we noticed in this *Magazine* (vol. xiii. p. 278).

The word Geography, it is true, is taken in a very wide sense. But in the times dealt with in this volume the state of geographical knowledge cannot adequately be understood without reference to the state of general culture, and therefore our author was quite justified in extending his researches beyond the strict limits of geography. Besides, the Icelandic civilisation of this period is a subject full of the deepest human interest. In the first half of the seventeenth century, owing principally to the Danish trade monopoly, the former material prosperity of the island had almost completely vanished; morality and general culture were at the lowest ebb, whereas superstition and witchcraft flourished. It is a very curious fact, ascertained by the author, that in Iceland witchcraft was practised almost exclusively by men. These were not conditions favourable to scientific observation, and the study of geography shared in the universal decay of intellectual pursuits. The second half of the century, however, shows a marked improvement in geographical literature. For the first time some of the interesting natural phenomena of Iceland were scientifically investigated. Thord Vidalin studied the glaciers, and his theories, crude as they appear to us now, were fully two centuries in advance of their time. Geographical studies received a great impulse when, at the beginning of the eighteenth century, the Danish Government at last took steps to raise the material condition of the island, and as a preliminary measure ordered a general survey to be made. This was carried out almost entirely by two men, Arni Magnusson and Pall Vidalin, and resulted in a kind of Icelandic Doomsday book. The greater part of their work is fortunately preserved, and is an invaluable source of geographical information. The author mentions several other descriptions of Iceland published during the eighteenth century by natives, and pronounces them to be written, on the whole, in a rational spirit, whereas those written at the same time by foreigners are still full of fables of the most childish nature.

The translation of this volume, which presented special difficulties, deserves unqualified praise.

Die Reste der Germanen am Schwarzen Meere. Eine Ethnologische Untersuchung von Dr. Richard Loewe. Halle: Max Niemayer, 1896. Pp. 269. *Price M.* 8.

Dr. Loewe has set himself the task of tracing the history of isolated settlements of Teutons on various points along the coast of the Black Sea. Beginning with Asia Minor, the Greek writer Theophanes, in the first quarter of the eighth century, mentions the *Gotthograikoi* as living on the south coast of the Propontis, or Sea of Marmora. Our author supposes them to have been descendants of the Heruli who made a plundering incursion into Asia Minor in the year 267. The author of the anonymous *Periplus Ponti Euxini* mentions the *Eudusianoi* as using the Gothic and Tauric language, and dwelling somewhere on the north-east corner of the Black Sea in the direction of Anapa and Gelenjik. By Tauric we have probably to understand the language of the Alans. Procopius seems to mention the country under the form *Eulysia*, and to place it east of the Maiotis, extending as far north as the Tanais or Don. He also mentions the Tetraxite Goths, who occupied what is now the Taman peninsula, though they are said originally to have lived on the opposite side of the Bosporus, in the north-east corner of the Crimea. Dr. Loewe supposes that the word Tetraxite, which is not Teutonic, is connected with Tmutarakan. An older form may have been *Tmutrak*, and this may have been given to the locality by the ancient Sindi, or by the Kerketi, the modern Cherkes. In the middle ages Tmutarakan was also called Matrika and is now Taman. He further gives reasons for believing that the Tetraxite Goths were descended from the ancient Heruli, who had been driven

out of the islands of Denmark by the invading Danes. The Eudoses of Tacitus, who were probably Heruli, may be compared with the Eudūsanoi of the anonymous author, and, if this equation is correct, the latter were Teutons. They seem to have preserved their nationality in the twelfth century, for in a Russian ballad, which narrates the disastrous expedition of Igor, prince of Novgorod, against the Comans in 1185, mention is made of Gothic maidens. The poem shows that the Goths were fighting on the side of the Comans, and that the scene of the action lay between the mouth of the Don and Tmutarakan. As late, indeed, as 1482, a Genoese merchant makes mention of the Gothic princes at Matrega (Taman), who ate up all he had, and this obliged him to write to his friends at home for one thousand ducats to satisfy their rapacity.

The earliest mention of a Gothic-speaking people in the Crimea is to be found in a Slav legend of the second half of the ninth century, where it is stated that the people of Sudak, the Kozari and the Gothi, prayed to God in their own language. Various authors are quoted, who speak of Goths in the Crimea down to the time of Busbeck. In 1589 the latter published a short list of words which he took down in Constantinople from a Greek who was acquainted with Crimean Gothic. A few of these are loan-words from Persian and Turkish ; some are etymologically uncertain, but the bulk of them is certainly Teutonic. According to Dr. Loewe, the dialect, in some respects, stands nearest to Anglo-Saxon, and the West Germanic dialect, from which the Crimean Gothic developed, was probably spoken in the neighbourhood of the northern part of the Anglo-Saxon country on the Continent, that is to say, in Jutland and North Slesvig. This was the country of the Heruli, and from them are descended both the Tetraxite Goths and those that dwelt in the south-west corner of the Crimea. After the time of Busbeck, these Goths are hardly mentioned, but it is probable that some of their blood still flows in the veins of the Hill Tatars of the Crimea, who differ physically in a very remarkable degree from the Nogai Tatars in the northern part of the peninsula.

Die Wettervorhersage. Eine gemeinverständliche praktische Anleitung zur Wettervorhersage auf Grundlage der Zeitungs-Wetterkarten und Zeitungs-Wetterberichte für alle Berufsarten. Im Auftrage der Direction der Deutschen Seewarte bearbeitet von Prof. Dr. W. J. van Bebber, Abtheilungsvorstand der Deutschen Seewarte. Mit zahlreichen Beispielen und 125 Abbildungen. Second Edition. Stuttgart : 1898. Pp. 215 and Index.

The importance of forecasting the weather is great, and the science is of practical benefit to all classes of society, not only to sailors and agriculturists, but also miners, etc. It is certain, as Dr. Van Bebber says, that even the educated public do not understand the method by which to a great extent a knowledge of the probable weather may be ascertained some days in advance. With this book in their hands, any educated person can understand how it is possible to forecast the probable weather, for a most clear account is given of the method by which such knowledge is ascertained, and with the numerous charts the subject is made clear and comprehensible. There are nearly 200 charts showing the condition under which various kinds of weather are produced, so that any one almost who obtains the daily meteorological reports can himself—without trusting to newspapers—become a weather-prophet. It would be well were this book translated into English or a similar production compiled here, because the existing books do not give such a comprehensive and comprehensible account of the subject, which may be either treated in a strictly scientific or popular form. We have nothing but praise for this publication.

Grundzüge der Pflanzengeographie. Von F. Höck. Breslau: F. Hirt, 1897. Pp. 188. 50 Figs. 2 Maps.

This compact book, designed for use in schools and colleges, deals with the flora of Germany and the whole world, not forgetting the sea. It is carefully and clearly written, and well illustrated. We think that the author should have given more emphasis to the central problem of *explaining* the present distribution of plants, or, if that be too ambitious, of illustrating in greater detail the numerous known factors which determine the character of the flora in different countries and the plant-associations in particular areas. But his terse and reliable descriptions of the facts are admirable; and if the book's centre could be adjusted to Britain, it would well deserve translation.

Perigrinazioni Anthropologiche e Fisiche. Del Dott. Tito Vignoli. *Studio Comparativo tra le Forme Organiche Naturali e le Forme Geometriche Pure.* Del Prof. G. V. Schiaparelli. Milano: Ulrico Hoepli, 1898. Pp. 367. *Price*, L 5.

The part of this work written by Dr. Vignoli consists of a series of essays on various subjects, of which, perhaps, the only one of geographical interest treats of the cause of the intercrustal heat of the earth. In this article, written in 1882, he deals with pressure as one of the sources of heat, and thus anticipates the theory of Major Powell (see p. 437), who, however, shows more clearly how differences of pressure may be produced.

Professor Schiaparelli's comparison of organic forms with geometrical is, of course, illustrative only. It leads him to certain lines of thought on the variations of organisms supplementing the Darwinian theory.

Russian Hosts and English Guests in Central Asia. By J. T. Woolrych Perowne. London: The Scientific Press, Ltd., 1898.

The writer of this book expressly disclaims for it any value as an exposition of original exploration or research. It is, in fact, merely a description of a journey from Vienna to the eastern terminus of the Trans-Caspian Railway, and it is offered, as the author says, "rather to our Russian hosts and friends as some slight token of my sense of gratitude for all they did for us, in order that some monument, however humble, might exist, recording in how hospitable a manner a party of English people has been received by our traditionary foe in a far-off part of the world, where that foe is popularly supposed to be more inveterate and more insidious and more dangerous than anywhere else." No one can peruse the book without perceiving that, whatever the writer's views regarding Russia were when he began his journey, at the end of it he was a pronounced Russophil, and had been captivated by the uniform kindness and lavish hospitality of his official hosts. This book does not compete, then, with the well-known works of Curzon, O'Donovan, etc., but can be recommended as a well-written account of a very pleasant holiday tour lasting for two months in the end of 1897, when the writer and his friends were personally conducted and most hospitably treated by the Russian officials from Batoum to the Zarafshan valley, a little way beyond Samarcand. He gives his readers an interesting but by no means novel description of such well-known places as Baku, Ashkabad, Merv, Bokhara, and Samarcand, all of which he saw to the best advantage. The illustrations are numerous and exceptionally good.

NEW MAPS

EUROPE.

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FORMA URBES ROMÆ. Formam dimensus est et ad modulum delineavit Rudolphus Lanciani Romanus. Fasciculus sextus.
Presented by Mrs. Hugh Rose.

AMERICA.

CANADA, Dominion of ——. Scale 1 : 5,070,000, or 80 miles to an inch.
W. and A. K. Johnston, Edinburgh and London.

A boldly drawn and coloured wall-map showing the latest additions to geographical knowledge, and the boundaries of the new districts. We may remark that the Liard forms the boundary between Yukon and Mackenzie as far as the mouth of Black river. The Alaskan boundary is shown from the British point of view, and the United States' claim is also indicated. A small text-book accompanies the map.

AMÉRIQUE DU SUD, physique et politique. Atlas Universel de Géographie, ouvrage commencé par M. Vivien de Saint Martin et continué par Fr. Schrader. Nos. 76 et 76 bis. *Librairie Hachette et Cie., Paris.*

The physical sheet shows the configuration more conspicuously than the sheet of France we noticed a few months ago. In the mountainous parts greater clearness might be obtained by the omission of some of the names. The political sheets show the latest modifications of boundaries and the French claim on the north of the Amazons.

ATLAS.

UNITED STATES, Geologic Atlas of the ——. Folios 26 to 37. Scale 1 : 125,000.
U.S. Geological Survey, Washington.

As the first numbers of this monumental work were issued in 1892 and were noticed in vol. ix. p. 676, it may be well to state again its principal features. Sheets are given showing the topography, areal and economic geology, structure and columnar sections. To these are added, where the nature of the country requires it, sheets illustrating special features such as artesian water, deformation, etc. Each folio is accompanied by descriptive letterpress. Of the above, one represents the Yellowstone Park.

CHART.

KIRKWALL BAY. Surveyed by Captain W. Usborne Moore, 1895-96.
Presented by the Hydrographer to the Admiralty.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE ISLAND OF SOKOTRA.

By Mrs. Theodore Bent.

(*Read at the Meeting of the British Association, Bristol*, 1898.)

Sokotra is a difficult island to get at. We at first thought of trying to reach it from Aden in a sailing boat, but found that we should have to coast along Arabia to Ras Fartak and then let the north-east monsoon blow us to Sokotra. However, a British India steamer was induced to deviate, as they call it, and leave us at Kallenzia, on the north-west coast. We landed through the surf and seaweed in a lifeboat. Though on the map the island looks as if it were a washed-away bit of Africa, it is politically Arabian, for it is ruled over by the son of the Sultan of Kishin, the chief of the Mahri or Mehri tribe.

We were told before we left Aden that the chief language in the island was Mehri, and at one time thought of taking with us a man who could interpret from Arabic to Mehri, but after all we took no interpreter from Aden. This was fortunate, for we found that it was necessary to take the Sokoteri or Sokoterioti language into consideration. We therefore engaged a native who talked Arabic (with us) as well as both the other two languages.

We had to remain encamped at Kallenzia a good many days, awaiting the return of the messenger from the Sultan, who lives beyond Tamarida, bringing us his permission to move on and to hire camels. Though many passengers bound for Australia have had a passing glimpse of the island from their steamers, it is an island that has been very little visited. During late years there have been two botanical expeditions, one led by Professor Bailey Balfour and one by Dr. Schweinfurth, the results of which gave us much knowledge of marvellously strange and, up to that time, unknown plants.

We spent two months there in the early part of last year, and traversed the island from end to end, trying to unravel some of the mystery in which its ancient history is shrouded, as well as to become acquainted with its present inhabitants.

Mariette Bey, the eminent Egyptologist, identified Sokotra with To Nuter, a place to be bracketed with the Land of Punt, in the pictorial decorations of the temple of Deir el Bahri, as a resort of the ancient Egyptians in search of frankincense and myrrh. Certainly there can hardly have been a spot within reach of the ancients where could be obtained so many of the products coveted at that time—the ruby-coloured dragon's-blood (the *Draco Kinnabari* of Pliny), three distinct species of frankincense and several kinds of myrrh, besides other valuable gum-producing trees, and aloes of super-excellent quality.

Dr. Schweinfurth sees in the name of Sokotra a survival of the Hindoo appellation Diu Sukutura, which the Greeks, after their easy-going fashion, changed into Dioscorides. This interpretation is very ingenious and most likely correct.

When the Portuguese arrived in 1538, they found the Arab Sheikh dwelling in the capital of the island, called Zoko at that time, now in ruins and called Souk, which is probably also a survival of the ancient name. The present capital, a few miles off, is called Tamarida by Arabs and foreigners, but Hadibo by the natives. The former name is probably a Latinised form of the Arabic *Tamar*, the date fruit.

The old capital of Zoko, now Souk, lay in a delicious spot: the ruins are buried in groves of palm-trees near a lagoon of fresh water, separated from the sea by only a narrow belt of sand and shingle, and it seems highly probable that this lagoon was the ancient harbour. The southern coast of Arabia affords many instances of these silted-up harbours, and on the northern coast of Sokotra there are many lagoons or *khors*, as they are called, running sometimes as much as a mile inland. The view at Souk over the wide lagoon fringed with palm groves on to the jagged heights of the Haghier mountains, rising immediately behind, is among the most enchanting pictures I have ever seen.

Excavations at Souk might bring to light interesting remains of former inhabitants, but they would have to be deep, as there is much soil, and recent houses have been erected.

Much is said by old writers about the Greeks who colonised Sokotra in ancient times, but it is hard to believe that the Hellenic world ever carried its enterprise so far in this direction. If the Greeks did, they left no traces of their sojourn here. The few inscriptions we found seemed purely Ethiopic. We found one at the west of the island, near Kallenzia, very much obliterated, but in Ethiopic characters of late date, and another inscribed stone at the eastern end bearing similar lettering.

The large flat inscribed surface at Eriosh in the north is covered with purely Ethiopic *graffiti*, exactly similar to those we found in and around Axum in Abyssinia. They consisted of long serpent-like trails of Ethiopic letters, interspersed with rude drawings of camels, snakes, and so forth. There were scattered about numerous representations of two feet, frequently with a cross within the outline of one of them.

There were likewise crosses in circles and separate crosses like those we see on Ethiopic coins, and what seemed to be little plans of buildings. The surface on which all these things are inscribed at Eriosh is very soft, and one could easily cut into it with pebbles. It seems like petrifying mud, though Lieutenant Wellsted describes it as being extraordinarily hard. Close to this flat inscribed place are many tombs of an ancient date, reminding us in their construction of those of the Bedja race, once dwelling on the shores of the Red Sea, north of Sawakin, and subject to the Emperor of Ethiopia.

Probably the islanders received their Christianity from the Abyssinian church. Marco Polo, who touched at Sokotra, alludes to the Christianity of the inhabitants: Francis Xavier and Father Vincenzo describe a base kind of Christianity existing as late as the middle of the seventeenth century. No sign of this now remains, and so ignorant are the natives of what a cross is, that they have no word to express it. In their religious nomenclature the only way they differ from the Moslems is in having another name for devil. We also found a rock near the east covered with rude crosses of Ethiopic form.

There is a tradition that Franks once inhabited the ruined villages one sees in different parts, and that they were of the accursed sect of the Nazarenes; but as the churches were probably as flimsy in construction as those we saw in Abyssinia, there is nothing left by which to identify them.

Sokotra without the Haghier mountains would be like a body without a soul. The Haghier mountains make it in every sense of the word. Rising, as the range does, to a height close on 5000 feet, Haghier occupies a central position; with its many jagged peaks it catches at all seasons of the year the fugitive sea mists which so rarely visit the Arabian coasts. Bubbling cascades and deep pools are found in all its valleys in the driest season, and in the rainy season these become impassable torrents, sweeping rocks and trees before them. The hill-sides up to the edges of the bare granite pinnacles are clothed with thick vegetation. Three considerable streams run southward from Mount Haghier, fertilising three splendid valleys, and, as they approach the sea, losing themselves in sand. To the north there are many more streams, and, inasmuch as the sea is nearer, they all reach it, or the silted-up lagoons already alluded to.

Some of our camps on Mount Haghier and the expeditions therefrom were very delightful. At a spot called Adahan, where a sort of pass winds its way through the mountains, we were encamped for some days at an elevation of 3000 feet above the sea-level, surrounded by lofty peaks. Here the mist descended on us and we were enveloped in clouds, rain, and wretchedness, but for all that we scrambled about seeking plants and land-shells, and taking photographs and sketches whenever there were gleams of sun. It was so pleasant to rove about alone, in such safety that for the first time for many years we had no soldiers with us. There was a lovely stream near our camp fringed with flowers, including pink begonias.

All about Mount Haghier, at an elevation of 1000 feet, are scattered

dragon's-blood trees, which look more like an umbrella turned inside out than anything else. The gum is collected still, but as the tree is now found in more enterprising countries, Sumatra, South America, etc., the export from Sokotra is practically *nil*.

The great *Adenium* has a swollen stem, in colour pinkish like the baobab, but it is crowned with a few distorted and stunted branches bearing a pretty cluster of pink flowers something like oleanders. Some trees I saw were only four feet high and nearly triangular in vertical section, as the trunk tapers rapidly, and really the things looked more like rocks than trees when overgrown with lichen. Some, of course, were much taller.

The cucumber-tree (*Dendrosicyos Sokotrana*) is only found in this island. It has a whitish grey stem. Amongst the woods on the mountain slopes a number of them look like a decoration of candles. The tree has a serrated thistle-like leaf and a yellow cucumber flower.

To the south of Mount Haghier we came on a valley entirely full of frankincense-trees, with rich red leaves like autumn tints, and clusters of blood-red flowers. No one touches the trees here, and this natural product of the island is completely ignored. There are myrrhs, also ignored, and other gum-producing plants. The gnarled tamarisks afford a delicious shade; oddly enough the natives know the value of its fruit and make a cooling drink therewith. Then there are the euphorbias, which look as if they were trying to mimic the dragon's-blood trees: the branches of the euphorbia are thrown into the lagoons to kill the fish, and the milky juice is rubbed on to the bottoms of the canoes to prevent leakage. Such are the oddest of Sokotra's vegetable productions. There are also wild oranges on Haghier, bright yellow when ripe, but bitter as gall to the taste. Wild pomegranate also, with lovely red flowers and small yellow fruit, of which only the flannelly coating is eaten, instead of the seed as is the case with the cultivated one. The Bedouin would bring us aloes both in leaf and in solution, hoping we should buy this venerable Sokotran production, but now very little of it is collected, and every one may help himself; but in olden times, when aloes were an object of commerce, the plantations were strictly divided by the walls which we saw now running uselessly far up the mountain-side.

Tobacco and cotton are grown in small quantities, and one could not help thinking that tea and coffee might also thrive at the higher elevations.

Among other things which grow plentifully is the same awful grass that we met with in South Africa, with a seed like a long barbed fish-hook, as well as several others equally pernicious, which penetrate relentlessly into everything. Grass thorns invaded our night and day raiment, getting into places hitherto deemed impregnable, tormenting us both in mind and body. The large quantities of flocks and herds, and the amount of butter that is exported, prove that if properly farmed the island might prove a very great source of profit.

While we were in the island the season was exceptionally dry, and the lambs and sheep suffered very much—far more than the goats—from want of fodder. Most of the villages were abandoned for the mountain

caves, to which the shepherds generally retire in the hot weather when the pasture gets burned up lower down. Cows are more numerous than one would expect. They are a pretty little breed, smaller than our Alderney, with no hump, and with a long dewlap. They are fat and plump, and excellent milkers; their owners stroke and caress the little cows till they are as tame as dogs.

There is not much cultivation. Still, the natives sow a little jowari in tiny fields dotted about the valleys, with walls of stones round them to keep the goats off, and also the better to retain soil and water. Sometimes we saw a papa, mamma, and son sitting and tilling the ground with pointed bits of stick, for other tools are unknown to them.

Scattered over the island are numerous villages or hamlets, consisting of from five to ten little round or oblong houses and round cattle-pens. We were informed by a competent authority that there are four hundred of these pastoral villages between Ras Kallenzia and Ras Momi, a distance of some seventy odd miles as the crow flies, and from the frequency with which we met with them on our marches, I do not think the number is overestimated. If this is correct, the population must be considerably over what is supposed, and must approach twelve or thirteen thousand souls; but owing to the migratory character of the inhabitants, their lives being spent half in houses and half in caves, a census would be hard to obtain.

Sokotra has been under Mahri rule since probably some period before our era, for Arrian tells us that in his day the island of the Dioskoroi was under the king of the Arabian frankincense country, and the best days of the island were long before Arrian's time. In spite of this the inhabitants have managed to preserve a language distinct from either Arabic or Mahri. It is naturally strongly impregnated with words from both these languages, but the fundamental words are distinct. In subtlety of sound Sokoterioti, as they call it, is painfully rich, and transcribing the words caused us great trouble. The people corkscrew their lips, gurgle in their throats, and bring sounds from most alarming depths, but luckily they do not click. Polysyllables are numerous. I will not give you a lesson in Mahri and Sokoteri, but will merely mention that a word in such frequent use as our little word *I*, is in Mahri *Hemukomon*, and in Sokoteri *Evomùksham*.

In a parallel list of about three hundred words taken down in the presence of Mahri, Sokoteri, and Arabic-speaking people, there are more words derived from a Mahri than from an Arab source.

In Marco Polo's time, as now, there is a mysterious glamour about the inhabitants of this island. They bear a very uncanny character among their neighbours, if those of the outer world with whom they have dealings can be called such, and two nervous Somali lads we had with us were in great fear of being bewitched by them, though I doubt if they were less afraid of me and my camera. They had heard a story of a woman of Maskat, who having been bewitched by a Sokotran, was compelled to swim over to the island in the form of a seal. This imputation of magic power has survived long, for in ancient days the Sokotran women were believed to lure ships to their ruin, and to have the power

to produce storms or calms at will. As to the natives of Tamarida, they are very much afraid of certain jinni or goblins who haunt the stream, and they never, if they can help it, go near it at night.

Kallenzia, whence we started, has a lagoon of its own, fringed with mangroves, from which the inhabitants drink, and from which passing ships obtain water, though very fetid and nasty-looking from decaying vegetation. We preferred to drink from a brackish well hard by our camp, till we discovered a nice stream under the mountain, three miles away, to which we daily sent skins to be filled. The shore is rendered pestiferous by decaying seaweed, which forms quite a cake on the sea for some distance, and the drying bodies of sharks, from which the tails and fins have been cut for exportation.

The inhabitants are just the mongrel kind of people one sees in any coast town of Arabia. The houses are tidy and pleasantly shaded by palm-trees, and have nice little gardens with gourds, melons, and tobacco: the little streets are clean and strewn with sand.

We were recommended not to attempt to visit the south-western corner of the island owing to the drought, so we gave that up.

It took us five days to get from Kallenzia to Tamarida, and we found the water question rather a serious one till we reached Mori and Kadhohp or Kadhoup, where the higher mountains begin. Mori is a charming little spot with a lagoon, palms, and bright yellow houses as a foreground to the dark blue mountains, where many flamingoes strut about. Kadhoup is a fishing village built by the sea, with a sandy and marshy waste between it and the mountains. It possesses a considerable number of surf boats and canoes and catamarans. Between Tamarida and Kadhoup the spurs of Mount Haghier run right out into the sea, and the bold rugged coastline, with the path connecting the two places, is as fine a one as I have ever seen.

We heard much of the perils of the said path, and of the bleaching bones of camels which had fallen into the abyss below. Lieut. Wellsted had given a very bad account of it, and the camel men and their Kadhoup friends tried hard to make us go by boat, which we refused, though as a last resource they came privately to terrify my weak woman's mind. We did see a camel's bones, but none of our animals went over, and we revelled in the beautiful surroundings, which made us think little of the first of many toilsome clamberings over the rocks of Haghier. The views inland up the rugged yellow crags covered with verdure and studded with quaint gouty trees were weird and extraordinary, and below our feet the waves dashed up clouds of spray. It was marvellous to see the camels struggling along this path, and awful to hear their groans, and the yells of the camel-drivers as they scrambled up and down and in and out of the rocks; and parts of the way were so bad, and in other parts the overhanging rocks were so low, or again the path was so much too narrow for a loaded camel, that we had to engage twelve men to carry the baggage slung on very long poles.

As we went from the mountain to the plain we passed close to what would seem to have been a ruined fort above the sea, on a cliff, evidently intended to guard this path.

We hired camels for our onward journey from Tamarida merchants, the sole camel-owners, as the Bedouin own nothing but their flocks. Capital camels we had, the best we have ever met with, so large and strong. Of the drivers, some were Bedouin and some blacks, on the whole honest and obliging, with, of course, the usual keen eye to possible gifts.

The eastern end of the island is similar to the western, with low spurs of Haghier continuing to Ras Momi, which is spoken of as though it were the end of all things—quite a Finisterre. The spurs are intersected by valleys, and there is a table-land stretching right away to Ras Momi, at an elevation of 1800 feet above the sea-level. This table-land is a perfect paradise for shepherds, covered as it is with much rich grass, but deficient in water, which has to be fetched from the valleys below; but as the eastern end generally is far the best watered, it is far the most populated.

On the lower ground are found quantities of wild donkeys, whether the descendants of originally tame ones or not cannot be said. Some are dark, some white, and the Bedouin complain that they trample their flocks to death, and like if they can to catch the donkeys alive and tame them. Their skins seem more glossy than those of the domestic species.

Leaving Tamarida, at first we kept along lower ground, passing the shores of Khor Garria, a very long inlet which stretches inland for at least two miles, and then we ascended to the plateau which runs to Ras Momi. We found large numbers of Bedouin dwelling in deep caves in the surrounding cliffs—their summer resorts; and as we mounted we passed Godahan, a peak about 2000 feet high, with a large hole pierced in it, through which we could see a patch of the sky. I have a photograph of it. Behind this peak there is a curious flat ridge, raised not many feet above the table-land, which is called Matagiote, and is honeycombed with fissures and crevices forming perfectly delightful homes for people of troglodytic tendencies. Huge fig and dragon's-blood trees grow in these crevices, and there is a quantity of coarse grazing, but little water. We got ours from two very nasty holes where rain-water had collected and many cattle been washed. Before we left, the water had assumed the appearance of porter. When these holes dry up the Bedouin have to go to the lower valleys.

As Ras Momi is approached the country assumes a wilder and more desolate appearance. There are no trees, only low bushes, stunted lichen-covered adeniums, plenty of grass and little water; yet, strange to say, in this part we found more traces of former habitations than in other parts of the island. We advanced to the edge of the plateau, and looked over the cliff at Ras Momi, the eastern cape piercing the Indian ocean, with a series of diminishing heights ending in coral reefs. The waves were dashing over the wreck of a German vessel which went down with all hands some few years ago. Several fragments of German print were offered to us as treasures of fabulous value. It was not long after we were in Sokotra that this eastern cape acquired an additional lugubrious interest for us by the loss of so many English lives.

After leaving Ras Momi we took a south-western path, and after

several days' weary journeyings reached the valleys among the high mountains, where there was plenty of water. We climbed some of the mountains and looked over Noget, the sandy plain toward the south, and finally entirely traversed the range. The Haghier mountains, though red, are so covered with a black lichen, which leaves so very little of the rock showing, that one might think they were black mountains with a little red lichen on them. The summits are so very spiky that several of them well deserve the name of needles. I saw two high up which were connected by a fallen rock forming a bridge, and the topmost pinnacle of one, Mount Adouna, is split. I only discovered this from Feréghet by seeing a little cloud pass through.

The general word for mountain is *feddam*: that for water, *diho*. Many of the watering-places have such names as Dia, Dihelemnitin, Limditarr, Dimax, etc.

The rivers also seem to have some black lichen growing under them, as their beds are black. We found a great many non-marine molluscs on reaching Tamarida, or Hadibo, as we had then learned to call it.

We had as much difficulty in getting away as we had had in finding means of reaching Sokotra. A letter had been sent by our steamer to Bombay, begging that we should be fetched away in two months. No answer came, but a baggela arrived with news of the plague. We feared to delay making plans of escape till we heard if the steamer refused us or no, as if we delayed too long the monsoon would change, and then we should be left in the lurch, with no power of departure till the next change. The Sultan laid an embargo on all boats but his own, and with an immense deal of trouble the price of his Majesty's baggela was haggled down from £300 to £50; but we started at last and reached Aden in five days, having several times lost our way in the ocean.

OCEANOGRAPHICAL RESULTS OF THE AUSTRO-HUNGARIAN DEEP-SEA EXPEDITIONS.

By Dr. K. Natterer.

(*Read in Section E of the British Association, Bristol*, 1898.)

Through the assistance of the late Admiral Baron von Sterneck of the Austro-Hungarian Navy, who commanded the flagship in the battle of Lissa in 1866, the Vienna Academy of Sciences has been enabled to carry out a series of deep-sea expeditions for a period of eight years. Having been invited to take part in the expeditions as chemist, I considered it part of my duties to investigate the causes of the scarcity of animal forms in the depths of the Mediterranean compared to those of the ocean.

Until 1890 the water in the depths of the Mediterranean had been held to be almost completely stagnant; and large expeditions had only

been undertaken previously in the western half of the sea. It was believed that the poverty of animal life in the depths was due to the existence of muddy water on the bottom, and to the absence of a sufficiency of dissolved oxygen in the water.

With regard to the oxygen, I found that in summer the quantity in solution below the surface at first increased (corresponding to the sinking temperature), but afterwards diminished; however, these variations were so unimportant that even in the greatest depths the water was almost or quite as rich in oxygen as at the surface. When care was taken to prevent the water-bottle from touching the bottom and thus stirring up the mud, perfectly clear water was always obtained.

The mud, sand, and particles of rock broken off by the waves or carried by land winds or rivers into the sea, and not deposited near the coast, are brought in contact with a great mass of sea-water by means of currents and are dissolved. That solution actually takes place is proved by the fact that in certain parts of the sea dissolved minerals are continually being separated from the water. This is of course the case when molluscs and corals secrete their shells, and diatoms their siliceous cases; and, besides this, true chemical precipitation is brought about by the large amount of ammonia produced in the mud by the progressive oxidation of organic substances. The nature of the deposit depends on whether at any particular place small shells from the surface water, or other hard particles, sink to the bottom or not; according as these are present or absent the deposit will consist mainly of carbonate of lime, or of ferruginous clay, mixed with clayey silicates of potassium and sodium, with manganese, silica, and carbonate of magnesia.

Where shells or particles sink from above their decomposition results in the production of a soft or powdery deposit; in other places a stony layer covers the bottom of the sea. The former condition is the rule; and by far the greater part of the bed of the Mediterranean is covered with a typical ooze in which minute shells and fragments of the calcareous and siliceous skeletons of small organisms are embedded. However, in some regions of the eastern Mediterranean where the basin is contracted, and particularly round Crete, the mud of the sea-bed is covered over by a stony deposit, through which diffusion takes place as through a membrane. In the oxygen-free mud, rich in salts of ammonia, under this crust, the infiltrating water dissolves the manganous and ferrous oxides; and when these diffuse through to the upper surface of the crust, and come in contact with the oxygenated sea-water, ferric oxide and the black peroxide of manganese are at once or in quick succession precipitated. Thus the black colour of the stony crust is produced, which gives the upper side an appearance not unlike that of volcanic scoriae.

Sooner or later the formation of such a crust by the precipitation of carbonates and silicates, etc., comes to an end owing to the exhaustion of the organic matter in the mud, the slow oxidation of which gave rise to the necessary ammonia and carbonic acid. When this happens, the solvent power of the sea-water, especially in those regions where there is little material falling from above, may effect the re-solution of the stony

crust and its underlying mud. With respect to re-solution, the question whether a continuous renewal of the water takes place by means of currents reaching to the bottom is important, as on it depends the possibility of a sufficient supply of the appropriate precipitants on the sea-bed or in the deeper layers of the mud to create in the course of time a deposit, or an accumulation in some particular place of some special substance from the sea-water, which contains in solution a little of every substance on the earth, even of gold and silver.

A series of chemical observations indicates the existence of movement throughout the whole mass of the water in the Mediterranean. Of this general movement the circulation of the surface water, which, as has long been known, moves towards the east along the African coast and towards the west along the coasts of Europe, must form a part, in so far at least as the surface water is borne along on the water which lies beneath.

The secretion of bromine and iodine from the sea-water by small free-swimming algæ (diatoms) has contributed to the recognition of the movement of the eastern Mediterranean waters. This secretion is most active off the African coast, to the west of the Nile delta, in the uppermost layers of water. The movement is also indicated by the absence, total or partial, of nitrous acid in the uppermost layers owing to the reducing action of vegetable organisms. Further, a movement, mainly horizontal, of the various layers of water, one over the other, is to be expected in the large, very deep, and uniform depression between Egypt, Syria, and Asia Minor.

Through such movement the lower layers must have been kept for a long time from rising to the surface and coming in contact with the atmosphere. To this circumstance must be ascribed the fact that the lowest value for dissolved oxygen in the whole eastern Mediterranean was found along the submarine slopes of the Syrian coast.

In the south-eastern angle of the Mediterranean, where, for the reason just given, as well as on account of the lower specific gravity due to the influx of Nile water, the same layers of water remain for a long time at the surface, and are thus exposed to sunlight, *more* oxygen was found than could have been absorbed from the atmosphere. The explanation of this is to be found in an increased amount of oxygen production on the part of the vegetable marine organisms. A larger proportion of oxygen than corresponded to the temperature was also frequently observed on board the *Challenger* and *Voeringen*, and later also in the sea of Marmora. In the eastern Mediterranean, and apparently also in wide districts of the ocean, the minute marine plants yield a considerably larger amount of organic material than can be completely oxidised at the same time, whereas, in general, the sea gives up oxygen to the atmosphere.

Together with light-coloured ooze there is often found, particularly in the northern part of the Ægean Sea, an ooze of a darker colour ; the thickness of the light-coloured layer varied in different parts of the eastern Mediterranean, and often was only a few millimètres thick, and off the Syrian coast it covered a black deposit containing sulphide of iron. As a rule the sounding-rod and also the dredge, which penetrated

about ten inches into the ground, brought up only the light-coloured ooze; hence as a rule the freely circulating sea-water, rich in oxygen, is able to penetrate to this depth into the deposit and prevent the formation of dark-coloured organic substances, or even of sulphide of iron.

On the submarine slopes of the coast of Palestine and Syria the remains of small plants and animals fall to the bottom in considerable quantities, being carried thither by the great masses of water which sweep in throughout the whole depth of the sea from the west, and curve round to the north. As this agent has been a long time in action, a large amount of organic matter must have accumulated in this region, which must on the one hand have brought about the reduction of sulphate of iron to sulphide, and on the other yielded the material for the formation of petroleum. Indeed, between Cyprus and the Syrian coast not only the deposits, but also the water collected immediately above the bottom, showed traces of petroleum.

The *infiltration* of sea-water into the deposits on the floor of the sea gives rise, by chemical reactions and hydration, to the absorption of a certain amount of water in the ooze and in those parts of the earth's crust to which it penetrates. A second process is also going on. Wide districts of the land surface, in the neighbourhood of the Mediterranean, particularly the Sahara, receive scarcely any rain, so that the underlying beds of sand and rock (so far as they are permeable to water and come in contact with the bed of the sea) must suck up the sea-water like a dry sponge. Other parts of the land, which are without rain only at certain seasons and become dried up only to a certain depth, can exercise this capillary action only occasionally. The analysis of the waters of some springs in Crete and the neighbouring island of Cerigo gave results which are compatible with such a capillary absorption of sea-water by the rocks.

After four summers spent on the *Pola* (Captain von Mörth) in the investigation of the eastern Mediterranean, I was appointed in May 1894 to carry out chemical investigations in the sea of Marmora on board the Austro-Hungarian guardship at Constantinople, the *Taurus*, commander the late Captain von Hermann. The superficial current through the Bosporus brings into the sea of Marmora water which is reduced to half the normal salinity by the great rivers Danube, Don, Dnieper, and the first object of the investigation was to study the conditions of the deep water, which one would expect to be shut off from the atmosphere by the light brackish surface layer. It appeared, however, that no such complete exclusion of the deep water from atmospheric influence as occurs in the Black Sea takes place here. None of the many samples of water collected at great depths contained sulphuretted hydrogen, nor did any of the numerous specimens of the deposits (the greatest depth sounded was 730 fathoms) contain sulphide of iron.

The enormous number of floating organic particles, *i.e.* living and dead plankton, reduced the transparency of the upper layers to less than half of that observed in the eastern Mediterranean. These organic particles sink to the bottom, and the more gradually they sink, on account of the horizontal movement of the water, the greater is the amount of

oxygen which their putrefaction uses up. The utilisation of oxygen is thus greater than in the Mediterranean, and one of the consequences is that in many places the deeper water layers show a lower alkalinity than that of ordinary sea-water, on account of the carbonic acid produced by the oxidation of the organic matter. The diminished or vanished alkalinity corresponds to an increased solvent power, and consequently in the deep region of the northern half of the sea few or no calcareous shells are mixed with the mud; they become completely dissolved before reaching the bottom. The solution is further helped on by the reduction of the nitrogen in the organic particles, during their protracted descent through the various currents, to ammonia, so that the progressive oxidation produces mainly carbonic acid. It had been already noticed in the eastern Mediterranean, and particularly in the Ægean Sea, that on some parts of the bottom solution and not precipitation predominated; and this condition is the rule in the sea of Marmora. Such solution may become of special importance in those places where the submarine slopes of the coast are very steep, for there, after solution has taken place for a long time at the base of the slope, a landslip may result in the upper part. It may also happen that the great amount of carbonic acid causes caverns to be formed in the deeper layers of the grey calcareous ooze, the roofs of which may afterwards fall in. It is even possible that such action was the cause of the earthquake experienced in that region in the summer of 1894. After the earthquake the Russian investigators found an increase of depth in several places in the sea of Marmora.

The determinations of nitrous acid have indicated that the water does not remain long stationary in the depths of the sea. The nitrites formed by the action of micro-organisms in the darkness of the deep water come here and in other seas sooner or later near the surface, where they are utilised by marine plants and ultimately give rise to ammonia, which, entering the atmosphere, is carried away by the wind and precipitated by rain upon the surface of the land. By the so-called disturbance of chemical equilibrium the ammonia transferred to the atmosphere by the sea may exercise a determining influence on the place and rapidity of the formation of mist, cloud, and rain.

The movements of the deeper water in the sea of Marmora, which take place contrary to the direction of the hands of a watch, retard both the inflowing streams, the upper current through the Bosporus and the under current through the Dardanelles, which on account of the earth's rotation have a tendency to deviate to the right, and compel them to deviate to the left.

In this sea the temperature of the water below 160 fathoms is somewhat higher than that prevailing in the Mediterranean at the same depths, but it is subject to greater variations. On account of the flow of water from without through the sea of Marmora, there must be a particularly active circulation of the whole mass of the water in a vertical direction, so that not only the winter cold but also the summer warmth of the surface layers is carried down. In other enclosed seas only the surface water which has become cold and dense in winter sinks as a rule to such a depth as to encounter the under-currents; while in

the depths of such seas the mean winter temperature of the surface prevails, the mean temperature of the deep water of the sea of Marmora must in the course of time approximate to that of the surface for the whole year.

In the central parts, particularly in the centre of the deepest region, the comparatively fresh surface water is to a certain extent drawn down by the general vertical circulation of the whole mass. These descending currents render the specific gravity of the water of the sea of Marmora from surface to bottom lower in the middle than near the margin. If hydrostatic and not hydrodynamic equilibrium prevailed, the level in the middle of the sea would stand about 20 feet higher than at the edges.

The deep-sea fauna, including fish with luminous organs, red crabs with great eyes, etc., is much richer than in the eastern Mediterranean, and the distribution of the fauna is in strict accordance with the hypothesis that fresh water rich in oxygen descends to the greatest depth in the centre, while water poor in oxygen rises along the margin. In spite of the general low percentage of dissolved oxygen in the greater part of this sea, the rapid circulation enables the deep-sea fauna to thrive by bringing in an abundant food-supply and preventing the accumulation of waste products. This strengthens the probability that the greater abundance of deep-sea life in the ocean is due to the more rapid circulation of the water, which, presumably, is associated with tidal action. Scarcely any doubt can exist that a general movement of the whole water takes place in the Black Sea also, producing a certain degree of mixture and removing through the outflowing surface current of the Bosporus part of the salt water, which enters as an under-current, and on account of its high specific gravity sinks from the level of the floor of the Bosporus (27 fathoms) to the bottom of the Black Sea in 1420 fathoms.

As the *Pola* again became available for deep-sea research, the Vienna Academy of Sciences decided to carry on an investigation in the Red Sea, which is only separated from the Mediterranean by the Suez Canal. The country on both sides of this sea being almost unexplored, the programme of the expedition included the survey of the coasts, meteorological observations, and determinations of the constants of terrestrial magnetism and gravity, carried out by the naval officers. The first of the two expeditions under Captain P. von Pott was concerned with the northern half of the Red Sea, and lasted from October 1895 to May 1896.

Only along a few stretches of the coast are there great shallows, on which coral reefs have formed and a great wealth of plant and animal life appears. For the most part the coast sinks in a very steep submarine slope, and almost along the whole length of the sea the depth exceeds 550 fathoms and in some places 1100. The Gulf of Suez, on the other hand, has an average depth of only 27 fathoms and a maximum of 45, and consequently sunlight reaches to the bottom, and the whole water swarms with minute pelagic plants and animals. The Gulf of Akaba on the east of the Sinai peninsula is separated from the main depression of

the Red Sea by a ridge rising to within 70 fathoms of the surface, but it was found to be almost everywhere over 270 fathoms deep, and in some places the depth attained 700.

As might be expected, organic matter predominated in the mud of the Gulf of Suez. The deposits formed in winter were less oxidised, and consequently more apt to give rise to ammonia by decomposition, than the deposits formed in summer. It is possible that in the shallow Gulf of Suez solution and precipitation alternate according to the season; perhaps the regular stratification of the mountain-chains on both sides of the Gulf is connected with this fact. Amongst the numerous coral reefs at the south end of the Gulf of Suez, in the calm water between which much of the floating organic matter that is carried out of the Gulf by currents settles down, distinct traces of petroleum were found in the bottom water (as was the case between Cyprus and Syria). The occurrence of petroleum on the neighbouring African coast at Jebel Zeit may perhaps be accounted for by the capillary absorption of sea-water either containing petroleum or giving rise to its formation. Petroleum exists also on the Syrian coast at Alexandretta. The mud on the bottom of the Gulf of Suez contains sulphide of iron, which is also found on the submarine slope of the Syrian coast in the Mediterranean.

In the northern half of the Red Sea scarcely any rain falls, and consequently the surrounding land consists of deserts, flat in parts, in others hilly or even mountainous. The results of the expedition show that the salt deposits of the desert can only be explained in a few places by the evaporation of portions of the sea which have been cut off from the main body. In nature, as a rule, the process of evaporation is comparable to that of a dilute salt solution in an unglazed earthenware basin. Long before the saturation point is reached one finds that salts begin to separate out, principally above the level of the liquid, on the edge of the basin and within the earthenware. The salt deposits in the different desert districts on the borders of the Red Sea, and particularly the ammonia salts, apparently originate from the evaporation of the water of the mud, formed at the bottom of the sea and rich in ammonia, and drawn upwards by capillarity. Deposits of gypsum and quantities of oxide of iron and manganese accompany the desert salt, and both of these can be readily explained by chemical changes due to reduction by the organic matter in the deposits and to oxidation by the oxygen of the air.

In this connection it was interesting to observe that the Gulf of Suez, where sulphide of iron abounds in the deposits, indicating a reduction of sulphates, is surrounded by great gypsum-bearing mountains. On the other hand, no gypsum deposits are found round the Gulf of Akaba, in which, on account of its great depth, the organic material has become more or less oxidised before it reaches the bottom, so that no reduction of sulphates can take place in the mud.

THE JOURNEY FROM SHANGHAI TO PEKING AND BACK.

By Major A. C. Yate, 2nd Baluch Battalion.

When I inquired in March last, at Hong-Kong and Shanghai, from Messrs. Kelly and Walsh, the principal booksellers of the Far East, for some guide-book that would tell me how to reach Peking, I was told that no such book existed. It was therefore by inquiry from my fellow-passengers between Colombo and Shanghai (many of whom were old residents of Hong-Kong and Shanghai, although one only of them had actually visited Peking) that I gathered sufficient information to enable me and my wife to make our plans for paying Peking a flying visit, while waiting for the *Empress* boat, due to leave Shanghai for Kobé on the 9th of April. The latest edition of Mr. Curzon's *Problems of the Far East* had appeared about a year before the Tientsin-Peking railway was opened, and therefore gave no information about it. On reaching Tientsin I found that there was in existence a guide to Peking, published by the press of the *Peking and Tientsin Times*, and sold at the exorbitant price of one dollar, its real value being about 25 cents. It was two years old, and, as it only described the old-fashioned road and river routes, quite behind the times. The railway has now been completed to a point called Machiapu, about four miles distant from the European quarter in the capital of China. A concession to construct an electric tramway from Machiapu to the city gate, about a mile from the European quarter, has very recently been granted to a German contractor. In the near future the number of visitors to Peking is likely to be multiplied tenfold, and therefore, pending the publication of a competent guide-book, a few notes on the route under its present conditions may be of some use to travellers.

It was not till late (10 P.M.) on the night of the 23rd of March that the P. and O. steamer *Chusan* landed its passengers at the landing-stage of the English Bund at Shanghai. As I had only sixteen days at the outside available for my visit to Peking, I set off at once, under the guidance of a Chinese servant of the Central Hotel, to find out what steamers were about to sail for Tientsin. (I say "Tientsin," because in old days the steamers used to go up to that treaty port. Now, however, the Peiho is so silted up that no steamer can ascend it. They all anchor off Tongku, near the railway terminus, a mile or two above the Taku Forts. All cargo goes to and from Tientsin in lighters, while the passengers go by rail.) I found two or three steamers at the wharves of the China Navigation and China Merchants' Companies on the French Bund; and having ascertained that none of them would sail before midday on the 24th I returned to the hotel. I must here point out that there is always a good deal of uncertainty about the date and hour at which any of the steamers leaving Shanghai for Chefu and Tientsin will start. They are cargo boats, carrying mails and passengers as a mere extra. They start when their cargo is on board and all is ready. The same uncertainty exists as to the starting of steamers on the return journey from Tongku, but of that more anon. Three companies—the

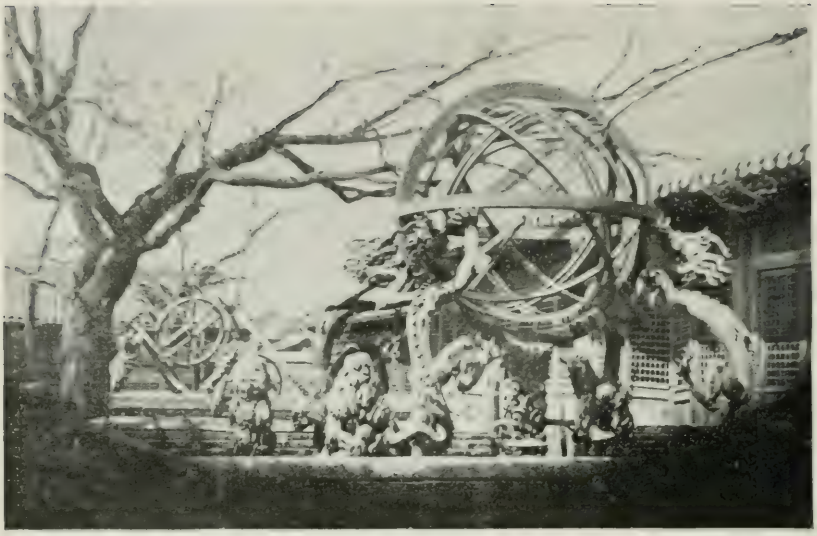
Indo-China (Jardine, Matheson, and Co.), the China Navigation (Butterfield and Swire), and the China Merchants'—run lines of steamers between Shanghai and Tongku. I do not think there is much choice between them, except that the China Merchants', alone of the three, allows Chinese passengers to travel in the saloon. The manners of these Chinese at table are exceedingly objectionable; and, moreover, they smoke opium in their cabins. With this exception I think the China Merchants' boats are as good as the others. I tried one of each company, and judge by my experience of them. As soon as ever these steamers arrive in Shanghai their departure for Tientsin is advertised in the local papers for the next day, but probably they will not start till the second or third day. On the other hand, at times they discharge, take in a fresh cargo, and are off again within twenty-four hours. At Shanghai it is quite easy for the intending passenger to ascertain when the steamer is really near its hour of starting, but at Tientsin it is impossible to learn what boats loading down at Tongku are doing, as will be explained presently. Nor is it an easy matter to decide, when there are three or four boats loading at once at Shanghai for Tientsin, which is the best one to take. Most of them call at Chefu, and may stay there discharging and receiving cargo for from four to forty-eight hours, or even longer. For Chefu, when a strong north-easter is blowing, is a very awkward anchorage. No loading or unloading can then go on. The steamers all run away under the lee of the Chefu Bluff, four or five miles distant from the wharves and godowns, and there they lie till the north-easter disappears. Therefore the time it will take the traveller to reach Tientsin from Shanghai, or to return therefrom, may be any time from three days to a week. Let me add that these steamers occasionally stick on the Taku bar, going in or coming out of the Peiho, for from twenty-four to forty-eight hours, or even longer. This is another little accident that has to be allowed for.

For my own part I have every reason to consider that good luck attended me. Of the five or six ships loading I decided to take the *Taishan* of the China Merchants' Company. We started at 3.30 P.M. on the 24th, passed the Shaweishan light outside the North Channel[1] of the Yangtse-Kiang about 9.30 P.M., and had a smooth run all the 25th to the south-east promontory of Shantung. We came in for none of the fog so common in the China seas. Rounding the Shantung promontory we met the north-east wind, and from that time to Taku we had unpleasant and bitterly cold weather. We passed close to Wei-hai-wei, little thinking that it was soon to pass into the hands of Great Britain, though the wish was a few days later father to the thought. The *Chungking*, of the China Navigation Company, ran side by side with us all the way, and the two vessels steamed into Chefu harbour within half an hour of each other. The *Taishan* had twenty-four hours' discharging of cargo to do, and a nasty sea to do it in. The *Chungking* was going on at once to Tongku.

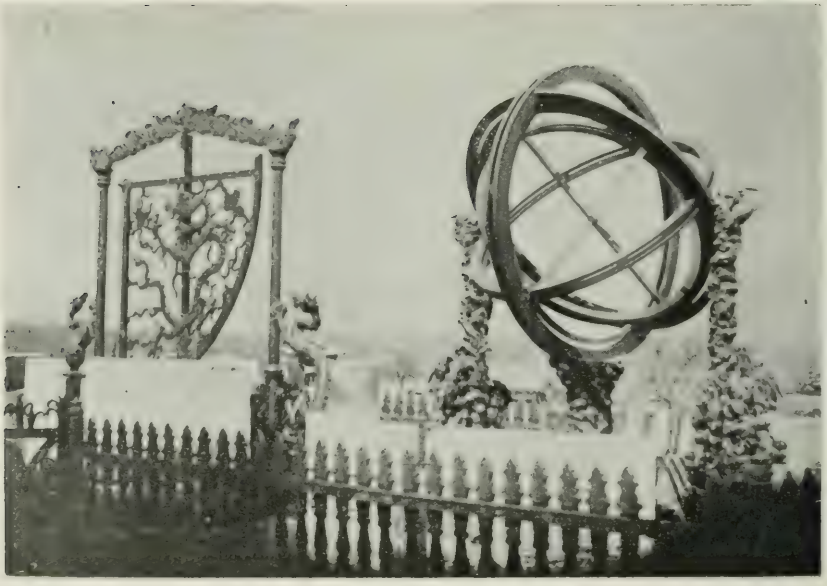
[1] The North Channel of the Yangtse is only navigable for steamers of small draft, and that by daylight. All the large steamers go up to Wusung (opened as a new treaty port in April last) by the South Channel. At night-time all steamers, large and small, have to use the South Channel.

1. THE LANDING-STAGE AT TONGKU.

2. CHINESE CARTS.



3. ANCIENT MONGOLIAN ASTRONOMICAL INSTRUMENTS.



4. ASTRONOMICAL INSTRUMENTS OF THE JESUITS.

Captain Klopfer of the *Taishan*, knowing that we were pressed for time, very thoughtfully proposed that we should change into the *Chungking* and go on to Tongku in her.[1] We did so in a sampan—rather awkward work in a lively sea; but we were rewarded by anchoring off the Taku bar at midday on the 27th March. A pilot came alongside at once in his tug and lunched on board. Through him and the captain we arranged to go ashore in a little Chinese tug. It was then about an hour after low tide. We got into the tug and started to cross the bar at about 1.30 P.M. We stuck on the bar before we had gone a mile and a half, and there we remained till the tide lifted us off about 3.30. We then steamed up the Peiho past the well-known Taku Forts to the unfinished landing-stage at Tongku (Photo 1). Our three and a half hours on the small dirty tug, amid a crowd of Chinese, had not been passed agreeably. At Tongku we scrambled ashore as best we could, and our luggage followed us anyhow. A crowd of coolies seized it and started for the station. We followed them blindly, and just caught the last train (at 5.15 P.M.) for Tientsin. A Chinese comprador procured us our tickets, and we found ourselves and our luggage all safe in a first-class compartment. Each first-class ticket cost 70 cents, and I also paid 20 cents for a baggage-permit. This last was apparently quite superfluous. No one checked my baggage or asked for the ticket. At Tientsin the porter (Chinese) of the Astor House was in waiting, and under his guidance we crossed the Peiho river (in a boat) and reached the Astor House (as the hotel is called) without difficulty or unpleasantness. I use these two qualificative terms because Chinese coolies may cause a stranger both, as we found out once or twice later on.

On the following day, the 28th of March, we left Tientsin at 11.30 A.M. in the mail-train for Peking. To this train, and to that which starts from the Peking terminus at the same hour for Tientsin, there is attached a carriage known as the Postal or Custom-House car. It is run entirely by the Customs Department, at the head of which is Sir Robert Hart, and Chinese passengers are not admitted into it. An official of the Customs Department accompanies each car, issues and collects the tickets, and looks after the luggage. The fare charged is double first-class. The ordinary first-class carriages have uncushioned wooden seats only. Into them are admitted not only the holders of first-class tickets, but not infrequently Chinese passengers who have second or even only third-class tickets. The manners of these persons are uncongenial, and their presence in the carriage apt to be unpleasant.[2] In addition to this, as the train is on the corridor principle, Chinese passengers of all classes are continually using the first-class compartments as thoroughfares. The Chinese railway officials exercise no authority or supervision in these matters. Hence the necessity for some conveyance on the line in which

[1] The return ticket from Shanghai to Tongku and back costs 60 taels, or about 80 dollars. It is available by any of the three lines I have mentioned.

[2] There are *coupés* holding up to four persons attached to each first-class carriage, and by payment of one extra first-class fare these *coupés* can be reserved. I never, however, found it necessary to take one.

Europeans can be secure from these unpleasantnesses. To have carriages on an Imperial Chinese railway to which Chinese were not admitted was a difficulty. The Post Office branch of the Imperial Customs Department solved it, by obtaining the right to run on each mail-train a car of its own; and to that car the Customs' authorities think fit to admit Europeans only. The distance from Tientsin to Machiapu, the terminus for Peking, is about eighty miles. The mail-train covers this in four hours. On 28th March the train was quite punctual; when we returned on the 31st March, it started nearly an hour late, and was proportionately late in reaching Tientsin. The trains on Chinese railways cannot as yet be relied on to run up to time.

At Machiapu two covered carts (see Photo 2), sent by the proprietor of the Hotel Tallien at Peking, met us. We had telegraphed for them from Tientsin in the morning. The telegram of a few words (nine, I think) cost nearly five shillings, for a distance of eighty miles. However, it secured our comparative comfort for the trying ride of four miles over one of the worst cart-roads imaginable. The jolting and, after the city is entered, the unpleasant smells, have to be endured. Life in Peking means a perpetual endurance of unpleasant smells.

Our return to Tientsin was a repetition reversed of the journey to Peking. We found on arrival at Tientsin, that the ice had just broken up at Niuchwang, and that most of the steamers were off to that port. The *Chungking*, which had brought us from Chefu, was due to start on its return run to Chefu and Shanghai that night (31st). We were too late to catch her. Further inquiries next day induced us to leave at noon (1st April) for Tongku, to catch the *Liensking*. We had to manage this move as best we could without any aid or interpreter. We found the coolies once or twice rather annoying. However, an officer of a steamer at the Tongku wharf pointed out where the *Liensking* lay a mile down stream, and by about 4 P.M. we found ourselves on board her. The hour of sailing, it then transpired, was quite uncertain. The cargo was on board lighters which had stuck in the Peiho between Tientsin and Tongku. The representative of Messrs. Jardine in Tientsin had assured me that the *Liensking* was certain to sail at 8 P.M. with the high tide, and urged me on no account to miss the midday train. And now we found that even the cargo had not arrived. About 6 P.M. we were delighted to see several lighters come alongside and loading recommence. Several thousands of bales and bags were, however, still missing, and when we retired for the night no one had the faintest idea when the ship would sail. It was, perhaps, some small consolation to us to hear that the *Chungking* had stuck on the bar on the previous night, and was still there. At or before daybreak I awoke, and my delighted ears heard the sound of signalling from the bridge to the engines and of the anchor being hauled up. I learned afterwards that they had induced the Customs to let them sail without the missing cargo. We were very light in the water, and about 8 A.M. crossed the bar, leaving the *Chungking* and half a dozen others still aground. Some of them had been aground for thirty-six hours, and the *Chungking* was full of passengers who had left the *Liensking* because the *Chungking* was

starting first. As it turned out, the *Chungking* did reach Shanghai first, for we spent nearly forty-eight hours at Chefu discharging and taking in cargo. I mention all these things in order to show how uncertain the traveller must always be as to the duration of the sea voyage from Shanghai to Tongku and back. The *Liesshing* reached Chefu at daybreak on the 3rd of April and left again about 2 A.M. on the 5th. We had the interest during our stay of visiting the British squadron which was anchored there, and which was then almost hourly receiving reinforcements. When we arrived seven British men-of-war were in the harbour. When we left there were fifteen, including the *Centurion* and the *Grafton*, the flagships of Vice-Admiral Sir Fitzroy Seymour and of Rear-Admiral Fitzgerald, the *Powerful*, the *Barfleur*, etc. The *Victorious* arrived a day or two later. We had a very smooth passage, and disembarked at Shanghai at 8 A.M. on 6th April. We found the life on all these coasting steamers rather trying; but what seemed to us faults in them are mostly those which are inseparable from small steamers, in which the passenger traffic is entirely subordinated to the cargo. All the officers were most attentive and obliging, and the Chinese servants ready to do all they could. If the ventilators from the lower parts of the forecastle and hold had been raised, so that the unpleasant smells that they released did not sweep the deck on which the passengers had to take the would-be fresh air, sitting or walking, it would have been a great boon. It was difficult to find a place on these steamers where there was not even a suspicion of an unpleasant odour. But these are little *contretemps* for which the traveller must start prepared. Camphor is considered a good protective. In Peking I always carried a piece in my handkerchief.

I have confined myself in this paper, as I said I would, to a description of the way to and from Peking, taking Shanghai as a starting-point. It is possible also to reach it from the Japanese ports of Kobé or Nagasaki, but these steamers call *en route* as a rule at Chemulpo in Corea and at Chefu. Thus the voyage from Kobé or Nagasaki to Tientsin lasts seven or eight days, a weary long time on a comfortless coaster. That Peking is well worth a visit goes without saying. Nor need any unpleasantness be anticipated. Reports are commonly current of the rudeness and insolence of the Chinese, and that to ladies. These occurrences, however, appear to be rare, and there is no need to apprehend any such thing nowadays in visiting Peking. It is Mr. Norman, if I remember rightly, who says that there are but two moments when the European traveller can honestly feel that his stay at Peking is a satisfaction to him: the one is when he first views it from a distance, and the other when he takes his last look at it. There is truth enough in this still. With all its interest, it is a most repulsive place. Mrs. Bishop remarks that she thought Seoul the filthiest city in the world till she saw Peking. If, however, any enterprising person or company will start a good hotel in a roomy enclosure (unused palaces and other residences are obtainable for the purpose), the traveller will there be able to find rest and comfort, and refuge from the foul sights and smells which he must endure when he goes abroad. The Hotel Tallien is close on a dirty street, and swarms with Chinamen. Its rooms are small and stuffy, its

charges high, and its *cuisine* and service indifferent. The traveller in Peking wants a place, like the roomy premises of the British Legation, in which he can forget for a few hours that Peking and millions of Chinamen are all around him. It is so restful to be able to get quite away from them. During our visit to Peking we met an officer who had been travelling for nearly a year in Manchuria, always among the Chinese. The one thing for which he was most thankful when he returned to the Legation was, that he had a good solid high wall between him and all prying Chinamen. In hotels in China (as also in Japan) the servants have a habit of bursting into the bedrooms, either without knocking at all or without waiting for a reply to the knock, every half-hour or so during the day. I soon learned to keep my door locked whenever I was in my room. The servants, however, were honest. I never lost the least thing. I am very glad that we visited Peking, but we feel no wish to repeat the visit in the near future. There were trying experiences in connection with it which we do not care to put up with when the charm of the unknown no longer lures us onward.

s.s. *Empress of India*,
May 1898.

NOTES ON THE PHOTOGRAPHS.

Photo 1 : *The Landing-Stage at Tongku.*—Since Tientsin was opened as a treaty port, the river Peiho has been gradually silting up, and there is now only, on an average, 7 or 8 feet of water in the channel. Steamers can no longer go up to Tientsin, so anchor off Tongku. Tongku, in short, has become the port of Tientsin, and wharves and landing-stages, to facilitate loading, are being constructed.

Photo 2 : *Chinese Carts.*—The cart shown in this photograph is an improved pattern of the vehicle in general use for passenger traffic by road in China. In these carts, which are the property of the Hotel Tallien, many European visitors make the journey from Peking to the Great Wall and back, some eighty miles in all. The four miles of road between the Machiapu terminus and the European quarter in Peking have to be traversed in these carts. That little journey is an experience in itself.

Photos 3 and 4 represent instruments in the Huan-hsiang-tai, or observatory of Peking. The larger armillary sphere depicted on Photo 3 is probably the work of the famous Chinese astronomer, Ko-chau-tsing, who lived in the thirteenth century. It is remarkable for the beauty of its workmanship, and shows that casting in bronze had been brought to a high state of perfection. The mode of dividing the circles, etc., is interesting as showing the knowledge of astronomy in China at the time of the construction of the instrument.

The other instruments, placed on a bastion rising above the eastern wall of Peking, owe their origin to the Jesuit missionary, Ferdinand Verbiest, who acted as astronomer to the Manchu Emperor Kang-Hsi. He pronounced the old instruments obsolete, and caused new ones to be erected in the year 1668.

ON THE ASYMMETRY OF THE NORTHERN HEMISPHERE.[1]

Of the main lines of elevation should be mentioned first the Kanin peninsula with the Timan mountains, Novaia Zemlia and Waigatz, the Urals, together with the Mugojars, which form a natural group ending between the Caspian and Aral seas at the river Chegan in lat. 46° 30′. To the Urals follow, in Western Siberia, a broad zone of folds with a north-eastern strike. Crossing the Kirghiz steppe towards Baian Aul and Karkaralinsk, they vanish under the plain and reappear at Kolyvan, and then proceeding farther towards the north-east cross the Ob and Tom, and at length reach the Alatau of Kuznetsk. The natural relations of the Uralian and Kirghiz folds are not clearly apparent, but together they form the most important part of the boundary of the west Siberian plain—the basin of the Ob.

Far in the north of Siberia, a little-known curved line of folds crosses the Taimyr and reaches the Arctic Ocean at Cape Cheliuskin. A far larger arc, running west and east, begins at the mouth of the Olenek. Passing across the delta of the Lena, it turns to the south-east, bearing the name of Khara Ulakh, forms the mountains of Verkhoiansk, and is continued in the north Stanovoi range north of the Okhota. It then makes another bend, similar to that from the Lena delta to the Khara Ulakh, and thus its main branch reaches the watershed of the Anadyr, Cape Chukotski, and St. Lawrence island. This is the Verkhoiansk arc.

It has, as far as is known, no connection with elevations on American soil. In the interior of Alaska formations of a totally different character appear. A huge range of gneiss stretches from west to east in the direction of the Tanana river, north and south of the 64th parallel, and along the chord of the bend of the Yukon; then, turning east-south-east and south-east, it forms the watershed between the Pelly and Lewes, follows the course of the Findlay, and must be considered as the continuation, though perhaps interrupted here and there, of the archæan rocks of the Cariboo district and of the Gold range in British Columbia. On its northern edge lie the sedimentary rocks, altered by pressure, which contain the gold of Alaska. To these succeed, on the north-east, the folds of the Rocky Mountains, their outer edge extending from the mouth of the Mackenzie to Wyoming. In fact, through British Columbia extends a mighty system, folded and thrust over towards the east, of which the western part is formed by the archæan chain of the Gold mountains, Selkirks, etc.

These mountains have, then, nothing in common with the Verkhoiansk arc. On the other hand, a massive zone of granite, with volcanic vents on its east side, forms the coast ranges in British Columbia, makes a curve northwards from Mount Elias, and probably merges into the arc of the Aleutian isles. The Commander islands differ somewhat from the Aleutian in their composition, so that a connection with Kamchatka is yet doubtful.

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[1] From a lecture to the Vienna Academy of Sciences, on April 1st, by Prof. Suess.

All the above ranges, from the Kanin peninsula to the Bering sea, are quite apart from the Eurasian folds, or at any rate they are not included in the same general plan. They are all folded towards the west, south, or east, and are concave towards the Pole. They have no equivalent in North America, unless the coast ranges are to be regarded as such. Horizontal Palæozoic tablelands extend over the Arctic archipelago of North America.

Lake Baikal and the basin of the Angara are begirt by a large hoof-shaped zone of very old folded rocks. On the north-east it reaches the mouth of the Great Patom in the Lena (60° N. lat.), and here the folds incline to the south-west; on the other side they are found to the north-west as far as below the mouth of the Tunguska; here the strike is towards the south-east, and is distinguishable here and there even to the 68th parallel.

This great amphitheatre also is concave towards the north. It encloses the East Siberian plain; at its edge flows the Lena in gently sloping Palæozoic strata, which in part go back to the Cambrian period. The amphitheatre, in great part at least, is older than the Cambrian age. A fault which runs on the right bank of the Yenisei from the country north of Krasnoiarsk to near the mouth of the stony Tunguska limits these rocks on the west. A second, probably pre-Cambrian, fault lies in the interior of the amphitheatre not far west of Lake Baikal. On the east the older rocks adjoin the Yablonoi, which is a fault mountain or a monoclinal flexure, not a folded range.

Through these three lines of subsidence, on the Yenisei, to the west of Lake Baikal and at the Yablonoi, the region of the older rocks receives more or less the character of an upstanding block (*Horst*), but to the south it cannot be separated from folded chains in the composition of which fossiliferous Palæozoic sedimentary rocks bear a part. East Saian is quite distinct from West Saian. The former is known as Ergik-Targak, and this name may well be applied to the whole range extending to beyond Krasnoiarsk. It does not appear to be sharply severed from the amphitheatre of older rocks at Lake Baikal, though near Krasnoiarsk Lower Devonian deposits are involved in its folds.

The older rocks between the fault on the Yenisei and the Yablonoi at Chita form the centre of the great system of arcs which, with many deviations and anomalies, but yet on the whole arranged according to a common plan, extend from Saghalin to Java, and as far as the Himalayas and the Persian Gulf. But though the centre, they are not the starting-point. Towards the middle of the mighty structure there seems to be, as far as can be judged by the scanty information obtained, a kind of reversed fold towards the interior, while farther outwards the folds are directed more and more outwards until the masking strata (*Deckscholle*) of the inner chains of the Himalayas and the great thrust planes of its outer edge are reached.

The structure of the Eurasian folds, so far as they lie in Asia, is after a plan already sketched out in the Pre-Cambrian age, but in many parts its configuration was in course of formation down to late Tertiary times, and probably is not yet complete.

The ramifications of the Tian-shan abut first on the transverse Kirghiz folds. North of Karkaralinsk the two opposite lines of direction come into collision, and only south of the most southern spurs of the Uralian folds do these branches find a free passage to the folded ranges of Central Europe. At the same time, the deviation of the force of compression towards the north, characteristic of Central and West Europe, becomes apparent. The arrangement of the Central European folds, however, from the gneiss of the Hebrides to the skirts of the Alps, though modified by subsequent movements, shows an unmistakable restriction of fold formation to a narrow area surrounded by upstanding blocks (*Horste*).

The succession of the Hebridean, Caledonian, Armorico-Variscian, and Alpine folds is on the whole uniform, and to a certain extent in contrast with the disposition in Asia, where not only in the interior but also almost round the periphery late folds occur, as though there were still a struggle for expansion; and therefore Europe appears as an appendage or lateral extension of Eastern Eurasia.

The views of Norwegian geologists are so divergent that a decision on the Scandinavian mountains must be reserved. It should also be remarked that recent movements going back far into the Tertiary period are frequent in the lines of connection from the Tian-shan and the Hindu Kush to the European mountains, and that the question is not yet decided whether the connection with Asia was situated at the epoch of the Caledonian folds in the same region, south of the Urals. At any rate the Caledonian gneiss is allied to that of the Hebrides, the older masses that crop out in the folds of the Ardennes possess the marks of the Caledonian discordance, and in the zone of Mont Blanc and in the Carnic Alps the Variscian type is visible underneath the Alpine folds.

The relations of the European ranges to the Atlantic Ocean are as follows:—

(*a*) The arc of the Western Mediterranean bends quite back at Gibraltar, so that no prolongation into the ocean can be assumed.

(*b*) The folds forming the Spanish meseta are similarly curved back, and therefore here, too, a western extension of any magnitude is inconceivable.

(*c*) As to the Pyrenees, speculation is impossible in spite of much recent and valuable research.

(*d*) The Armorican folds run from La Rochelle to the neighbourhood of the Shannon, in such a manner that a former prolongation into the region now covered by the ocean is exceedingly probable. In fact, the whole visible Armorican region is only the eastern end of a great broad arc with its convexity turned towards the north. In the main it originated between the Middle and Upper Carboniferous series, though it has been subjected to subsequent changes.

(*e*) The Pre-Devonian Caledonian folds, running south-west, are so placed in the north and west of Ireland that their outer edge must come in contact with the Armorican lines not very far west of the mouth of the Shannon, perhaps disappearing beneath them, as do those of the same curve farther east.

(*f*) Lewis and the Outer Hebrides, together with a small portion

of the peninsula of Western Scotland, form the foreground (*Vorland*) of the Caledonian folds, and are only the eastern margin of a huge archæan region, now covered by the sea, from which in former times was derived the great quantities of clastic sediments constituting in Wales and the neighbouring districts the thick mass of older Palæozoic deposits. The Hebridean gneiss had certainly a wider extension than is often assigned to it by prominent British geologists.

Hence it may be inferred that on the north of the North Atlantic is a broad archæan region, and that to the south of this lie folded curves bending northwards, in which the Upper Carboniferous rocks lie unconformably on older abraded folds.

It is a very remarkable fact that the configuration of the east coast of America is in harmony with these assumptions. Here, with the exception of a few tracts probably Caledonian, there are only two tectonic elements, and these bear the distinguishing marks of the folds *d* and *f*. They are separated by the strait of Belle Isle and the lower course of the St. Lawrence.

On the north lies the broad Laurentian, archæan mass, the Canadian Shield, spreading itself under the horizontally bedded Palæozoic deposits of the American Arctic archipelago far towards the Pole, and passing over to Greenland. To the south, on the coasts of Newfoundland, Nova Scotia, and New Brunswick appears a folded range, overlapped by Upper Carboniferous rocks, which bears as unmistakably the character of the western continuation of a greater range as the Armorican chains in Europe that of its eastern extremity.

This is prolonged in the Appalachians, running south-west, and recent observations prove that the south-western termination of these mountains is not where it has usually been supposed to lie, but that they turn in a great curve towards the west and at the same time exhibit large overthrusts, which lie towards the concavity of the arc, a phenomenon unknown in Asia or Europe, at least on anything like so large a scale. The western prolongation of the Appalachians vanishes in the lowlands of the Mississippi, but late research in Arkansas, Texas, and Indian Territory has demonstrated that the Appalachian folds come to light again on the western side of the Mississippi depression, and through the Ouachita mountains reach the 100th meridian from Greenwich in a long tongue split up into many isolated folds. Here is still more evident the divergence from the arrangement prevailing in Eurasia, for the *Vorland* lies in the hollow of the arc.

Within recent years the fact has been established that the Sierra Madre, which consists of granite and archæan rocks and follows the west coast of Mexico, continues over the Gulf of Techuantepec, and by a bend to the east passes into the chain which runs across Guatemala to the Amatique gulf. The Sierra Madre, then, has a concave formation similar to that of the southern section of the Appalachians. Accordingly, the descriptions hitherto given of northern Central America were incorrect. The whole Mexican Gulf and the Cambrian mass of Austin (Texas) intervene between the two concave chains.

With regard to the peculiar configuration of the Rocky Mountains

proper (Colorado Front range, etc.) there are many old and new problems which it would be rash to attempt to answer. It is certain that in the eastern part of the mountains, in Wyoming, the movement and folding have been directed north-east and north-north-east; in Montana, 45° to 46° N. lat., there are frequently overthrusts eastwards. Similarly, as already stated, the cordilleras in Canada are characterised by remarkable overthrusts eastwards. Thus the Laurentian mass is begirt with ranges on the east, south, and west, and the folding movement is everywhere directed inwards, that is, towards the west, north, and east. Now, in Asia the folds incline towards the east, south, and west, and in Europe towards the east, north, and west. Thus the European chains form a transitional phase between the Asiatic and the American structure.

Next we come to the consequences of the structure just described; and in the first place to the striking contrast between Eurasia and America, the former exhibiting a movement outwards, the latter inwards. From whatever point of view those best acquainted with Asia have regarded its configuration, they have all agreed as to the close unity of its structure, and often allude to a more or less concentric arrangement, or a movement of the mass outwards. American geologists, on the other hand, have propounded the doctrine, with various modifications, that mountain ranges owe their origin to the sinking of the ocean, that they have been thrust up by external pressure from out of the pre-existing core of the continent (in this case the Laurentian mass). Hence is derived the doctrine of *isostasis*, that is, the theory that an additional weight cast on the surface by sediment produces subsidence, counterbalanced at another place by upheaval.

This contrast in the general notions concerning the continents and their relation to the seas which has resulted from observations in Asia and America is, then, but a reflexion of the actual contrast in the structure of the continents. The contrast has been pointed out in earlier publications, and in 1887 Marcel Bertrand maintained the continuity of the Armorican folds across the Atlantic.

It follows that the Atlantic Ocean is of later origin than these mountains, as is indeed confirmed by other data. Much harder is it to understand the part played by the far older Pacific Ocean. In Asia one finds arc following on arc; often two meeting at an acute angle are surrounded by a larger one, as in Asia Minor and Iran. It may be conceived that on reaching an obstacle the largest arcs were transformed into long concave lines, like the Appalachians and the Sierra Madre. But this would involve the supposition that the original disposition of the West American cordilleras is older than the Pacific Ocean, that the northern coast ranges, with their long granite ridges dating no further back than Mesozoic times, and with their recent movements, are a later intermediate formation, and that the Cretaceous overthrusts on the north-eastern slope of the cordilleras are due to subsequent movements.

Further investigation into this question may be postponed till the southern hemisphere can be included. It is already quite clear that the contrast between the structure of North America and Eastern Asia indicates an asymmetry of the northern hemisphere dating back to the

Cambrian age. It cannot be called an original asymmetry, for the Laurentian rocks were also folded and, moreover, in Pre-Cambrian times. The direction of this folding seems to have been a quite independent one, but its strike is known only in a small part of the extensive region.

One is inclined to suppose that the formation of the arc in Asia, concave towards the north, is due to a defluxion of superfluous matter from the Arctic regions, that is, is connected with the flattening of the Polar area. A certain similarity can be perceived between this arc and the course of the moraines, as also the form of the glacier protuberances, which Chamberlin draws over the east of the United States. In the future it must be ascertained whether in the southern hemisphere there are curves facing the north, but even now the bearing of the Laurentian mass (with Greenland and a part of the Polar lands) on all such hypotheses is perfectly evident.

More striking than the connection with the pole of rotation is a certain relation to the magnetic pole, which lies in the midst of the region of confluence. In fact the distribution of the main structural lines seems to tell in favour of the connection suggested by Edm. Naumann and other inquirers between the mountain-creating forces and Earth magnetism, as though the latter were a phenomenon dependent on other factors.

Furthermore the distinction between tangential (folding) and vertical (sinking) movements must be more sharply marked out than heretofore. The relation of the younger Atlantic Ocean to the folded ranges illustrates this clearly. The ingenious comparison which Reyer drew long ago between mountain-folding and a flowing motion was then reasonably condemned on the ground that there was no fall to account for a flowing movement. As soon, however, as we can take a survey of the whole hemisphere and distinguish between regions of diffluence and confluence, the question acquires fresh importance.

In relation to the often discussed question of the permanence of the continents and oceans the following facts are recognised. Individual folds are interrupted and broken up into solitary blocks (*Horste*), and later folds are checked at these blocks. The positions of the region of diffluence and of the region of confluence, as well as the system of superficial tensions, indicated by the directions of the folds, have remained unchanged since the Cambrian period. But an equal degree of permanency is not exhibited by the oceans. During this period new oceans have been formed by subsidence, the sequence of which is shown by the overlaps. Other oceans have disappeared, partly in consequence of fresh subsidences, and partly through the piling up of new series of folds on the old plan.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting held on November 17th, the following ladies and gentlemen were elected Members of the Society :—

Aikenhead, Miss C.
Corbett, Miss J. G.
Duncan, Miss J. H.
Hay, Mrs.
Hunter, Miss E.
Irvine, Mrs. C.
Jamieson, Mrs. R. J.
Lang, Miss J.
Marshall, Miss A. F.
Ross, Mrs. Houston.
Smith, Mrs. J.
Allan, James.
Armour, Wm. N.
Arnott, Brigade-Surgeon, Lt.-Col. Jas., M.D.
Bannerman, J. P.
Burgess, J. A.
Callum, J. P.
Crookston, G. B.
Davidson, W. D., B.A.
Dempster, John.
Dickson, Arthur, Jun.
Drysdale, Alex.
Duffus, J. H.
Fairlie, H. C.
Gardiner, W. G.
Gibson, Hope.
Grant, J. Lyall.
Harrison, G. A.
Law, Andrew.
Lawson, J. M.
M'Culloch, David.
MacKintosh, James.
M'Naughton, Wm.
Manson, Wm.
Milne, W. Fraser.
Morris, J. D.
Muir, John.
Munro, T. R. D.
Pollard-Urquhart, M. A.
Ritchie, Robert B.
Russell, A. W., M.A.
Ross, H. Houston.
Smith, Stephen, B.Sc.
Stewart, James.
Thomson, J. K.
Tulloch, Frank G.

—In all forty-six.

The Honorary Fellowship of the Society was conferred on R. W. Felkin, Esq., M.D., F.R.S.E., for special services to the Society and to Geography; and ordinary Diplomas of Fellowship were granted to Andrew Houston, Esq. and Dr. C. W. Donald.

Dr. James Burgess was appointed Delegate of the Society to the Congress of Orientalists, which will be held at Rome in October 1899.

The following gentlemen were elected Corresponding Members for the current session :—

Anderson, E. Hay, Esq., . . *Mexico*
Angus, H. Crawford, Esq., *Nyassaland*
Ballivian, Don M., . . *Bolivia*
Bell, Dr. Robert, . . . *Canada*
Bodio, Professor Luigi, . . *Rome*
Chaix, Professor Paul, . . *Geneva*
Cockburn, Henry, Esq., . . *China*
Corstorphine, Professor, . *Cape Town*
Dingelstedt, Mons. V. . . *Geneva*
Harrington, Mark W., Esq., *Washington State*
Johnston-Lavis, Dr., . . *Monaco*
Margerie, M. de, . . . *Paris*
Mason, W. B., Esq., . . *Japan*
Mello, Professor Carlos de, . *Lisbon*
Mohn, Professor H., . *Christiania*
Mulhall, Michael G., Esq., *Buenos Ayres*
Penck, Professor A., . . *Vienna*

Pittier, Professor, . . *Costa Rica*	Thomson, J. P., Esq., . . *Brisbane*
Preece, J. R., Esq.. H.B.M. Consul, *Ispahan*	Wagner, Professor H., . *Göttingen*
	Wild, Dr. J. J., . . *Melbourne*
Russell, Professor I. C., *Michigan*	Woodford, C. M., Esq., *Pacific Islands*
Steffen, Dr. Hans, . . . *Chile*	Yate, Major A. C., . *Baluchistan*
Suess, Professor, . . . *Vienna*	

The Annual Business Meeting

was held on the same day in the Society's Hall, the Marquis of Lothian, President of the Society, taking the Chair.

The Marquis of Lothian was re-elected President, and the Vice-Presidents were re-elected, and the Earl of Moray was added to their number.

The following twelve Members of Council, who retire this year by rotation, were re-elected :—Dr. A. Buchan, Dr. G. A. Turner, Professor S. H. Butcher, Mr. John Geddie, Mr. R. S. Allan, Mr. Lewis F. U. Garriock, Mr. F. Grant Ogilvie, Professor C. G. Knott, Sheriff W. C. Smith, Mr. Coutts Trotter, Sir W. Renny Watson, and Sir David Stewart ; and in the room of the remaining members who retire by rotation, and of Professor Pirie, who resigns, eight gentlemen were elected, of whom the following have consented to serve :—Mr. C. J. Guthrie, Mr. W. W. Robertson, Mr. Herbert B. Finlay, Mr. Robert Irvine, Dr. J. W. M'Crindle, General Chapman, and Mr. James Spence, Aberdeen. All the other office-bearers were re-elected.

In moving the adoption of the report of Council (the text of which is printed at the end of this number), the President expressed satisfaction at the flourishing state of the Society, and then passed on to one or two questions of general interest. He insisted on the practical usefulness of a thorough knowledge of geography, and in this connection referred to the recent communication of the Rev. C. T. Wilson to the *Scotsman*, in which that traveller bears testimony to the thorough effectiveness of the control formerly exercised by the Khedivial Government over the Sudan provinces. Next, with regard to the question of Antarctic exploration, he expressed his surprise that the Government refused to give any assistance. At the present time their hands were of course full, but they appeared to accept it as a principle that scientific exploration was not the business of Government. He should like above all things to see the Antarctic regions explored and mapped out by a British expedition, and hoped that the Government would reconsider their decision. There was little time for delay, for foreign countries were moving in the matter. Lastly, the President stated that he had made every effort, officially and unofficially, to obtain Admiralty charts for Glasgow, but without success. Other Governments provided charts for consultation, free of charge, and he regretted that the British Government had absolutely declined to furnish these charts to the Society.

Sir John Murray, in seconding the motion, alluded to the naval preparations now being pressed on, and maintained that expenditure in acquiring new knowledge should keep pace with the increase of naval and military armaments. Referring to the chart question, he said that when he came to Edinburgh there was no collection of Admiralty charts in the city. He found that Edinburgh was entitled to them, and induced the University authorities to ask for them, as there was then no geographical society in existence. They were kept in unsuitable rooms in the University Library, and might with advantage be transferred to the Geographical Society.

Mr. Ralph Richardson having stated, in answer to a question from Sir Renny Watson, that the Society's map-room is open to all-comers, the report was adopted.

Mr. Thomas M'Kie, representing, with Mr. Bartholomew and Dr. Calder, the Edinburgh Committee of the Joseph Thomson Memorial, handed over to the Society a bust of the late explorer. It is a bronzed copy of the bust executed by Mr. Charles M'Bride for the Thomson Memorial at Thornhill (described in vol. xiii. p. 379), and is accompanied by a cast of the front panel of the memorial, whereon is represented Fame, holding a map of Africa, etc. A bust of Dr. Nansen, presented by the explorer, was also handed over to the Society.

The Chairman accepted these welcome gifts on behalf of the Society, and returned hearty thanks to the donors.

Meetings held in November.

The first ordinary meeting of the Session in Edinburgh was addressed by Mrs. Archibald Little on November 10th. Sheriff W. C. Smith presided, and Sir Henry Littlejohn proposed a vote of thanks to Mrs. Little.

Another meeting was held in Edinburgh on November 24th, the lecturer being Mr. A. H. Savage Landor, who narrated, for the first time at a public meeting, the events of his remarkable "Journey in Tibet." Professor Butcher, in introducing the lecturer, warmly commended his perseverance as an explorer, and the fortitude and coolness with which he had faced danger and suffering. At the conclusion of the address Sir John Murray spoke of the valuable scientific work Mr. Landor had accomplished under great difficulty, and congratulated him on being the first European to visit the sources of the Brahmaputra.

On November 9th Mrs. Little addressed the Glasgow Branch, when Mr. Paul Rottenburg took the Chair, and conveyed the thanks of the meeting to Mrs. Little.

The Dundee Branch met on November 2nd to hear Mr. Frederick G. Jackson lecture on "Franz Josef Land Explored." Mr. I. J. Weinberg presided.

On the following evening Mr. Jackson lectured to the Aberdeen Branch. Mr. James Spence took the Chair, and Mr. W. O. Duncan proposed a vote of thanks to the lecturer.

Meetings in December.

Lieut. Meiklejohn, of the Gordon Highlanders, who was present at the Dargai engagement, has consented to lecture on Tirah in Edinburgh, and at the Branches. The meetings will be held in the first half of December, but the exact dates are not yet fixed.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Ordnance Survey.—The maps on the scale 1 : 2500 of England and Wales are being revised. The revision was commenced in 1894, and has already been extended over several counties. The sheets published represent 9236 square miles. The publication of the 6-inch map was completed in 1890, and a revision is nearly completed. The area of revised maps published is 3788 square miles. The new series 1-inch map completed in 1870 was published in two forms, (1) in outline with contours; (2) with hills. The former was completed for England and Wales in 1896, and the latter will be completed in 1902. In 1893 the Treasury sanctioned the principle that these maps should be revised every fifteen years, and this work will have been brought to a conclusion in the present year for England and Wales. The new maps distinguish between metalled and unmetalled

roads, single and double lines of railway. Sheets covering 28,305 square miles of country have been published.

The Scottish survey on the scale 1:2500 was commenced in 1882, and a revision was begun in 1894. Revised maps have been published for an area of 2132 square miles. A second edition of the 6-inch maps of the counties of Wigtown, Kirkcudbright, Edinburgh, Haddington, Fife and Kinross has been published, and a revision of the rest of the country is in progress, and maps have been published extending over 1459 square miles. The 1-inch map of Scotland in outline was completed in 1887, and with hills in 1894. It has now been entirely revised, and maps have been published for an area of 2573 square miles.

In Ireland 7381 square miles have been surveyed on the 1:2500 scale, and the area published is 4876 square miles. Revised maps of the 6-inch scale have been published for an area of 16,770 square miles. The 1-inch map is completed and published, and a revision is commenced this year.

In Wales also, as well as in Scotland, the place-names are being revised, Mr. Lleufer Thomas having undertaken to examine them.

Iceland.—During the past summer Dr. Thoroddsen has explored the highlands north-west of Langjökull and the mountain region behind the valleys of Borgarfiord, therewith completing his survey of the island. The large lava-field Hallmundarhraun was found to proceed from a series of craters bordering Langjökull. The north-western side of Langjökull is split by long crevices, and has terrace-like slopes. In one of the crevices is a range of craters, but older streams of lava have been ejected from other fissures before the terrace-forming subsidences took place. Eiriksjökull and Langjökull, like other snowfields in Iceland, rest upon breccia tablelands rising above the general level. Probably all these tablelands were once connected, covering the interior of Iceland with a layer of breccia 3000 feet thick; the underlying strata are everywhere of Tertiary basalt. Five very steep glaciers descend from Eiriksjökull, three of them hitherto unknown, and nine new glaciers were found on the western side of Langjökull. The high land north-west of the latter (Storisandr and Arnarvatnsheidhis) consists of mighty pre-Glacial lava currents. On the plateau to the west (Tvidogra) lie numerous mighty moraines, with bogs and numerous shallow lakes in the depressions. The Tvidogra tableland is about 1500 feet above sea-level, and yields pasturage for large flocks of sheep; the lakes are full of trout, and the bird fauna is very rich.

In August Dr. Thoroddsen visited the mountains behind the Borgarfiord, pitching his tents at heights of 2000 to 3000 feet above sea-level, and investigated the south-western angle of Langjökull. The pre-Glacial volcano, Ok, 3800 feet high, was examined, and it was found that the pre-Glacial lava-streams, extending down to Reykjanes and the neighbourhood of Reykjavik, proceeded not from this mountain but from craters on Mosfellsheidhi. Ok has, however, poured forth pre-Glacial streams, which are visible, for instance, in Flokadalr. The mountains behind the Borgarfiord consist of tufa and breccia resting on a basaltic foundation. In the neighbourhood are several interesting deep lakes, such as Beydarvatn (?) and Hvalvatn, probably formed by glaciers during the ice period.—*Geographical Journal*, November.

ASIA.

The Survey of India.—During the year 1896-97 the principal triangulation of the Makran longitudinal series (see page 96) was extended westwards from the farthest western stations reached in the preceding season (Kuluri and Piaro in long. 66° 30′) for a distance about 75 miles, the three figures completed embracing an area of 1380 square miles. Topographical work occupied six parties in

Upper Burma, Sind, Baluchistan, and the Himalayas. In the first-mentioned country 5747 square miles were surveyed and 8690 triangulated in advance. 2244 square miles were completed in Sind on the 2-inch scale and 3635 square miles were traversed, and 810 square miles were completed by the Himalaya party. A sub-assistant superintendent, Khan Bahadur Imam Sherif, was despatched to Zanzibar to execute a survey of that island. In all, the areas topographically surveyed during the year aggregated 14,460 square miles. Also 78,718 square miles on the eastern and western frontiers were geographically surveyed, of which 11,718 were new country in Upper Burma.

The determination of the longitude of Madras, an important work satisfactorily executed by Captains S. G. Burrard and Lenox-Conyngham, has been already noticed (see p. 99). In the year under consideration Captain Burrard took the latitude with the zenith sector, and his result, combined with one of Mr. Michie Smith and two previous values, gives a mean value for Madras of 13° 4′ 8·02″ N. lat.

Tidal observations have been continued, as usual, at twelve stations in India, Burma, the Persian Gulf, the Andaman Islands, and the Red Sea. In connection with these operations spirit-levelling was carried on from Potanghi to Vizianagram and from Bilaspur to Katni, over a total length of 291½ miles.

The Marine Survey of India.—At the end of the season 1896-97 the Gulf of Martaban was being sounded by the *Investigator* and *Nameurry*. The soundings were found to differ considerably from those on existing charts, especially about the depths of twenty fathoms, where older surveys show more than forty fathoms. A general shoaling of the Gulf has long been suspected, but it seems incredible that it should have proceeded so rapidly since the surveys of 1826, 1854, and 1859, from which the old chart was compiled.

On October 1st, 1897, the *Nameurry* left Bombay, under the command of Lieut. Sinclair, and made some deep soundings and successful hauls with the trawl on the voyage to the Andaman islands, where she was joined by the *Investigator*. From November 4th till December 21st both vessels were engaged in the survey of the Cleugh Passage and the Coco Channel, and then the sounding of the Gulf of Martaban was resumed and continued till the end of the season by both vessels, except during a fortnight spent by the *Investigator* in making magnetic observations in the Bay of Bengal. These observations will be of great value in determining the lines of equal magnetic variation. Two shoals, apparently of considerable extent, were discovered by the *Nameurry* in lat. 14° 53′ N., and long. 97° 20½′ E., and in lat. 15° 4½′ N., long. 97° 36′ E., which will be examined thoroughly.

The report of the surgeon-naturalist contains particulars of the following trawls :—

Station.	Position.	Depth in Fathoms.	Deposits, Bottom and Surface Temperatures.
229	9° 29′ 34″ N., 75° 38′ 0″ E.	360	Green Mud, 48·5 F.; 82 F.
230	7° 40′ 0″ N., 76 0′ 52″ E.	824	Green Sand and Mud, 40° F.; 81·5° F.
231	7° 34′ 30″ N., 76° 8′ 22″ E.	836	Do., 40° F.; 82° F.
232	7° 17′ 30″ N., 76° 54′ 30″ E.	430	Green Mud.
233	13° 17′ 15″ N., 93° 10′ 25″ E.	185	Sand, 53·5° F.; 79° F.
234	13° 50′ 30″ N., 93° 26′ 0″ E.	498	Green Mud, 46·7° F.; 78° F.

The first four were made between Bombay and Ceylon, the fourth yielding the largest amount of material and the largest number of species. Entozoa seem to be

of not uncommon occurrence in the stomachs of deep-sea fish, a Trematode being discovered in the stomach of a *Xenomystax* and several Nematodes (thread-worms) in the stomach of *Macrurus sp.* At Station 230 many specimens of a species of *Parapagurus*, apparently new to the Indian fauna, were dredged up, all sheltered by *Epizoanthus* colonies. The large number of Alcyonaria was the chief feature at Station 231; when cut or lightly rubbed with the finger they become luminous. At Station 232 some hundredweights of deep-sea coral of the genera Caryophyllia, Desmophyllum, Solenosmilia, and Lophohelia, all hitherto undescribed species, were brought on board, besides a large number of other organisms, including two new species of Munidopsis, two new species of Paralomis, and a species of Cyrtomaia, the first record of the genus in Indian waters. The specimens of fish obtained at Station 233 were mostly of a rosy and orange colour, and many of them showed a distinct difference in colour between their upper and lower surfaces, such as is characteristic of shallow-water fish, whence it may be inferred that a considerable amount of light penetrates down to 185 fathoms. *Segramathia pulchra*, a swimming crab of a new species, and probably of a new genus, was also caught, as well as a Pylocheles, which burrows in water-logged wood and covers the opening of its den most effectually with the last joints of its claws.

Surgeon-Captain Anderson made also one or two excursions on land. At Table Island he searched in vain for the Megapode, stated by Marshall and Hume in their *Game Birds of India* to occur there. On Landfall Island, in the clefts of a cliff 20 or 30 feet high, live some small bats, *Taphozous melanopogon*, not hitherto observed on the Andamans, and on the reefs Planarians were noticed for the first time. From Moulmein harbour Dr. Anderson made a trip into the Salwin hill tracts in search of Fea's barking deer. He failed to obtain a specimen, but from the glimpses he caught of them, believes them to be identical with the barking deer of the Buxa Duars.

On February 4th Dr. Anderson left Rangoon for Calcutta, where he spent two months in working out the Echinoidea in the Indian museum, finding four species new to the Indian fauna—*Pharmosoma tenue*, *Caloplourus maillardi*, *Homipedina mirabilis*, and *Platybrissus remeri*. He then returned to Rangoon, noting on the voyage that the flying-fish flap their wings during their flight, and are able to change their direction in the air.—*Administration Report of the Marine Survey of India*, 1897-98.

AMERICA.

The Iles du Salut.—The Dreyfus case has, no doubt, suggested the publication in the *Revue de Géographie* (September) of an article on these islands, formerly called Iles du Diable. They are three verdant islets lying 27 miles to the north-north-west of Cayenne. They had a reputation for sterility, and on that account no use was made of them until the disastrous attempt at colonisation usually known as the Kourou expedition. In 1763 the immigrants brought from France were too numerous to find a shelter in the huts hastily erected on the banks of the Kourou, and many of them were landed on the group of islands, which were then named Iles du Salut, as they were expected to save the colony from extinction. Crowded on a narrow rocky area capable of holding only about 400 persons, the 2300 immigrants which by April 1764 had been landed here, without shelter or clothing and sometimes without provisions, exposed to bad weather and the stings of myriads of insects, were soon decimated. The colonisation of the Kourou was abandoned, and the Iles du Salut remained for a long period unoccupied. In this century a lazaretto was established there, which was removed to Mana in 1833, and after transportation of convicts to Guiana was

decreed in 1852, the central depôt was established on the Iles du Salut. In a letter to the Duc de Choiseul, dated 1763, M. de Fiedmont describes the islands. Finding no safe anchorage on the coast for vessels too large to enter the mouth of the Kourou, he visited the Iles du Diable. He found that they consisted of three islets of about the same area, lying in a triangle and forming three deep channels where large vessels could ride at anchor, or lie moored to the shore. The bay facing the continent, in particular, was well sheltered from the winds, and might easily be converted into an excellent port. He found little wood and water on the islands, but thought that rain-water might be stored in cisterns. The shores are rocky, and here and there jut out into promontories and cliffs. The most northern island is still called Ile du Diable.

Sir Martin Conway in Bolivia.—On September 13th a special meeting was held by the Geographical Society of La Paz, under the presidency of Señor Don M. V. Ballivian, to confer on Sir Martin Conway the honorary membership of the Society. After thanking the Society for the honour, Sir Martin Conway gave a brief account of his ascent of Illimani, a copy of which has been sent us by Don Ballivian.

The ascent was commenced on September 5th from the farm of Caimbaya on the slopes of Illimani. Accompanied by Don Ezequiel Guillen, jun., the guides Antonio Maquignaz and Luis Pellissier, and a few Indians, Sir Martin rode up the mountain for two and a half hours, as far as the mules could go, and then across rocky ridges beside a stream came to a narrow steep valley where the first camp was pitched at a height of 14,000 feet. The next night the party encamped on a moraine at the foot of a glacier 16,000 feet above sea-level, and on the 7th of September the night was passed 100 feet higher at the foot of a rocky escarpment which the climbers ascended next day, the Indians deserting half-way. They then came to the snow of a great glacier, and set up their tents beside the rocks at a height of 18,900 feet. The night was cold, with a minimum of 21° F., and seemed much colder owing to the sluggish circulation of the blood at that altitude. On the 9th, having reached the head of the glacier after a detour to avoid the crevasses, they saw a fearful precipice descending in the direction of Yungas, and on the left a hill which intervened between them and the summit of Illimani, which was named Pico del Indio. Beyond the highest crest visible from La Paz lies an extensive snow-field, almost level, from which the great peaks of the mountain are easily accessible. Finding it impossible to make their way round the Pico del Indio owing to the precipitousness of its flanks, the mountaineers were obliged to climb right over it, and this they found the most laborious part of their enterprise. Here Señor Guillen was obliged to turn back, as a foot was frozen; he sent next day some Indians who were very useful in lowering the baggage down the rocks. On the south-west side of the Pico del Indio the three highest peaks of Illimani came in sight, and no obstacle to their ascent presented itself, except the rarefaction of the air. Sir Martin chose the western peak, descended some 500 feet, and traversed the snow-covered plain with great labour, though the snow was firm. After three hours he came to the depression seen from La Paz, between the right slope and the central peaks; it lies at an elevation of 21,750 feet. Thence he reached the summit in an hour, though obliged to go very slowly and suffering much from the rarefaction of the air. The height of the culminating point is about 22,220 feet. Sir Martin Conway announced his intention to attempt the ascent of Illampu.

He has already, as announced in the *Geographical Journal* for November, tried to reach the summit of Sorata. His progress was stopped by a crevasse at a

height, he thinks, of between 23,000 and 24,000 feet. Should his estimate be correct, it may be true that Sorata is the highest summit of the Andes, as it was long believed to be. During the ascent the thermometer sank to 2° F.

OCEANS AND GENERAL.

The "Princesse Alice" in the Arctic Seas.—H.S.H. the Prince of Monaco has sent us the following communication on his cruise during the past summer:—

"The *Princesse Alice* left Havre on June 22rd, under the command of Prince Albert of Monaco, who was accompanied by Captain Carr, Dr. Jules Richard, M. Neuville, and the artist, M. Lovatelli, to assist him in his scientific researches. Mr. J. Y. Buchanan, on the invitation of the Prince, also joined the expedition.

"On July 24th the *Princesse Alice* arrived at Tromsö, after putting in at Kiel (where Professor Brandt was taken on board), at Bergen, and at the Lofoten Isles. The yacht set sail again on the 29th, having been joined by Mr. W. S. Bruce of Edinburgh. The 30th July was spent in a visit to Bear Island and the 31st at Hope Island. An attempt to advance northwards in the direction of the Kong Karl Islands was frustrated on August 2nd by the pack, which lay at 77° 30′ N. and 28° 25′ E. The yacht then changed its course, and, entering the Storfiord, anchored on August 3rd in Ginevra bay. On August 14th it cast anchor in the Smeerenberg bay, near Amsterdam Island, after various operations had been executed in Sassen bay and Advent bay. A visit was paid to Danes Island, where Pike's house was found to be in perfect condition, while Andrée's balloon shed had fallen into ruins. Steaming northwards on August 17th, the *Princesse Alice* encountered the pack at about 80° 30′ N. Finally attaining 80° 37′ N. lat., long. 6° 5′ E., the vessel then returned to Icefiord to take in coal and execute sundry investigations. She quitted Spitzbergen on August 30th, and reached Thorshavn (Faroe Islands) on September 9th, having dredged in depths of 1600 fathoms. She could not call at Jan Mayen or Iceland because of the bad weather. On September 14th the yacht reached Leith, and Havre on the 20th.

"This voyage was very successful, and afforded opportunities of making abundant zoological collections. In excursions made from the different anchorages valuable material was obtained in places little known and seldom visited, such as Hope and Barents Islands."

Rainfall on the Oceans.—On the basis of observations made on board the *Novara*, *Elizabeth*, and *Gazelle*, the material collected by Dr. W. G. Black, and the work of Köppen and Sprung and Von Danckelman, Dr. Supan has compiled a chart showing the mean annual rainfall in the Atlantic and Indian Oceans. In the North Atlantic a rainy area of considerable extent is produced by evaporation from the over-heated water of the Gulf Stream, condensed by the rising currents of air in the sub-Arctic cyclone. Southwards the rainfall diminishes towards the zone of the north-east trade-wind. The dry Sahara belt is undoubtedly continued into the Atlantic, though the precipitation is naturally a little greater than on land. At the same time it increases towards the west, where the air pressure diminishes and the trade-wind is less pronounced. The transition to the rainy zone of calms is very sudden. As this lies a little to the north of the Equator, the rainfall here is greater than in the south Equatorial belt. Southwards, again, the fall diminishes rapidly. As far as the south-east trade-wind prevails, there is little rain. The middle and west of the ocean in the higher tropical and sub-tropical latitudes lie

in the domain of the anti-trade-wind, and are marked by heavy rain. Another rainy zone is found in the Antarctic belt of westerly winds.

In higher latitudes the land is drier than the sea, for more vapour is produced here, and the conditions are favourable to condensation throughout the year. The same remark applies to the Equatorial zone; only the Amazons basin can in some degree rival the sea. In the higher latitudes of the Tropics the reverse is the case, the land being the moister because the drying influence of the trade-wind is only interrupted in summer. In the Indian Ocean the rainy tropical belt occupies a much broader space than in the Atlantic, owing no doubt to the great extension of the north-west monsoon. The trade belt proper seems to be somewhat moister than in the Atlantic.—*Petermanns Mitt.*, Bd. xliv. No. 8.

The Mean Temperatures of the Southern Hemisphere.—Herr W. Zenker published in his work, *Der thermische Aufbau der Klimate* (Halle, 1895), his revised calculation of the distribution of temperature in the open sea, according to the latitude. Herr Zenker derives his temperatures from the solar radiation, taking account not only of direct absorption by the atmosphere, but also of the diffused heat and the reflected heat from the surface of the sea. This work induced Dr. Hann to make a fresh calculation for the new edition of his *Handbuch der Klimatologie*. Taking 26° C. as the temperature at the Equator in the open sea, he made use of a formula expressing the diminution of temperature with the increase of latitude, and found that his results agreed fairly closely with those of Zenker. To ascertain how far they agreed with the actual temperatures, he took the means of the normal temperatures found by Spitaler and Batchelder, which reach only up to 60°, and from the observations of Ross and Borchgrevink assumed − 3° as the mean annual temperature of 65°. The mean temperature of the Southern Hemisphere worked out to 14·8° lower than in Dr Hann's previous calculation, but agreed with Spitaler's result. The following are the temperatures from Zenker and Hann's calculations, and from observation :—

	Equator.	10° S. lat.	20°	30°	40°	50°	60°	65°	70°	80°	Pole.
Zenker, .	26·1	25·3	22·7	18·8	13·4	7·1	0·3	—	− 5·2	− 8·2	− 8·7
Hann, .	26·0	25·5	22·8	18·1	12·3	5·9	− 0.2	− 2·9	− 5·2	− 8·4	− 9·6
Observed, .	26·0	25·4	23·0	18·4	12·0	5·6	0·1	− 3·0	—	—	—

Dr. Hann having made known these results in the February number of the *Meteorologische Zeitschrift*, M. Woiekof made in the May number some objections to them. He is not satisfied with the estimate of − 3° as the annual mean for 65° S. lat. The winds blowing from the south or east, and having passed over large areas of ice, must, he thinks, reduce the mean considerably below the above figure. From Dr. Buchan's charts he deduces means for 40°, 50°, and 60°, namely 12·1°, 4·9°, and − 1·9° respectively. As to higher latitudes, he considers that the figures given by Zenker and Hann are far too high.

In reply Prof. Hann points out that his results are not intended to apply to the highest latitudes, where land or large masses of ice exist; they represent only the temperature of a hemisphere consisting entirely of water. At the latitudes of 60° and 65° S. they may, however, hold good, for on the former parallel there is no land, and on the latter only 1 per cent. Dr. Hann then shows how he has obtained the value for 65° from observations on the *Erebus*, *Pagoda*, *Challenger*, and other vessels. Again the temperature of 65° N. lat., with 77 per cent. of land, is only − 4·5°, though the parallel passes through the Siberian pole of cold and through Greenland, Hudson's Bay, and other parts of North America where even the

summer temperature is low. Godthaab, in lat. 64·2°, has a mean of −1·9°; Jakobshavn, lat. 69·2°, −5·2°; and Angmagsalik, 65·6° N., −1·5°. It does not seem, therefore, extraordinary that on the oceanic parallel of 65° S. the mean should be −3°. If −3·5° be taken, or only 0·8 higher than the average for 65° N. lat., the calculated values agree closely with the observed, but in very high latitudes the temperatures are somewhat lower than in the former table (−10·3° for the Pole instead of −9·6°). How far the actual temperature of the Antarctic regions differs from that of the Polar regions of a water hemisphere is a question of the greatest importance in meteorology, and a complete series of observations at about lat. 70° S., extending over one or two years, would be of great value.

The Cultivation of Cotton.—It is much to be desired that students of commercial geography should have within their reach essays on the principal articles of commerce, showing where they are grown, under what conditions of soil and climate, the facilities available for transporting them to the emporiums of the world, the probable future extension of their cultivation, etc. As regards cotton MM. A. Lederlin and L. Gallois have done much to supply this want in an article in the *Annales de Géographie*, July 15th.

The simplest classification of the varieties of the cotton plant is into the cotton of Asia and the cotton of America, the former including *Gossypium arboreum* and *G. herbaceum*, the latter *G. barbadense* and *G. hirsutum*. To these may be added *G. peruvianum*, peculiar to South America, *G. taitense* and *G. tandvicense*. Cotton is a Malvacea which grows in tropical and subtropical regions, and occasionally even in temperate climes, though it does not there attain its full development. It never grows to a great height (the largest recorded was not more than 23 feet) and its period of existence is forty years at most. The cotton pods are produced in the first year, and now the bush is cultivated as an annual. The extreme limits within which the cotton bush will grow are 40° north and south of the Equator, but in the northern hemisphere its cultivation is seldom remunerative farther north than 37°, while in the southern it does not extend so far. It requires heat and moisture in a certain measure; too much heat scorches the plant, and too much moisture makes the pod decay. The most suitable soils are those which always retain a little moisture, alluvial and other soils moderately argillaceous. The plant is delicate and requires much attention, so that the labourers must be numerous. After the cotton is gathered it must be freed from the seeds, and this work is best performed by the American machines of the Whitney type. The best quality is nearly white, has a long regular fibre, fine and supple but tough. In America large quantities of oil are now extracted from the seeds, and an inquiry in 1881 elicited the fact that ninety per cent. of the salad oil sold in the United States was cotton oil. In the form of cakes the seeds are used as fodder for cattle, and they form a good manure.

Cotton was cultivated in India in very remote times; it is spoken of in the laws of Manu (800 B.C.), and in the first century of our era it was one of the articles, as we learn from the *Periplus* of the Erythræan Sea, which the Arabs brought from Barygaza, at the mouth of the Nerbudda, so that it was then to be found in the Deccan, where it is now grown. The soil of the north-western Deccan, including the Gujerat peninsula, is admirably suited for it. It is a mud coloured black by the admixture of vegetable matter, and is certainly produced by the decomposition of the underlying basaltic trap. It is also found in the south of the Deccan on a granitic base, wherefore it may be concluded that alumina is necessary to its formation. For centuries cotton has been grown in this soil

almost without any help from manure. Another advantage of the Deccan is its humid warmth.

The south-west monsoon carries enough moisture across the Ghâts to water the plateau in the interior, and towards the south-east, in the territories of the Nizam and in Mysore, where the rainfall diminishes, the inhabitants have from the earliest times retained water in tanks for irrigation. The cotton is sown in June, at the beginning of the rainy season, and the crop is gathered from November to May, according to the rapidity of growth. In the eastern part of this district there is a secondary rainy season, due to the north-east monsoon, and, where the rainfall is sufficient, seeds are planted in October or November. The alluvium of the Indus and Ganges is also suitable for cotton. In Bengal the humidity is too great, and cotton therefore does not thrive. In the middle valley of the Ganges, particularly in the Doab, the plants are watered both by rain and irrigation channels. In the Punjab they depend chiefly, and in Sind entirely, on artificial irrigation. Where the land is annually flooded by the river, the seeds are sown as soon as the water recedes, depending only on the moisture left behind in the soil. Elsewhere irrigation channels are a necessity. The seed-time depends on the conditions of irrigation.

Though cultivated from ancient times, cotton was not exported from India in a raw state before the present century. The total production in 1891 is estimated at 71,400 tons; in 1890 it had reached 576,000, after which it fell, gradually rising again to 534,000 tons in 1893. A considerable part of the yield escapes the statistician, namely, that appropriated to the use of the cultivators. The Indian cotton, short, hard, and generally badly cleaned, has never been able to contend with the American article in the markets of Europe. Only twice in the century has the exportation exceeded that from the United States, in 1818 and from 1862 to 1870, that is during and immediately after the War of Secession. As the price of American cotton has fallen owing to overproduction, it can be obtained as cheaply as the Indian.

The quantity exported to England in 1875 was 185,000 tons, while in 1897 it had fallen to 23,000 tons. That the production does not show a corresponding fall is due in great measure to the erection of mills in Bengal. There were 148 in 1895, employing 125,000 workmen, and absorbing half the production of the country. Also Japan takes more of the Indian export.

Cotton is found in a wild state in almost all the Sunda islands, but is very little cultivated. Java exports a little, but the fibre is coarser than the Indian. In New Guinea it is not found, though parts of the island are suitable for its cultivation, and in Queensland it has given place to the more remunerative sugar-cane. During the American War the cultivation of cotton was tried in various islands of the Pacific, but did not succeed except in Fiji, where seeds imported from Georgia have yielded fibre second only to that of the "Sea Island" cotton of the United States.

More important is the production in Indo-China, Japan, and China. Upper Burma and the Shan States supply a part of Yunnan, and the plant is grown in Cambodia and Cochin China, parts of Annam and Tonkin. The cotton of Cambodia, finer than the Indian and Chinese, is exported to Japan. In China, cotton is grown from Kuang-si and Kuang-tung to Shan-tung, and from Sze-chuen to Che-kiang, but it is in the lower Yang-tse-kiang valley that it finds the most favourable soil and climate. Being cultivated without proper care, it yields no very excellent quality. The production in China and Korea has been estimated at 286,000 tons, of which fully 53,000 were exported in 1895 to Japan. In the following year the export fell to less than half this quantity, owing to the erection

of mills in Shanghai, Ningpo, and Uchang. Japan produces cotton in the south and west of Hondo, and though the crop (45,000 tons in 1894 is insufficient to supply the native manufactures, a little is exported to Korea.

The cotton plant occurs more or less all over south-western Asia, but no great progress has been made in its cultivation except in Russian Turkestan. Here there is a native variety, which is still the most widely diffused. During the American War the Russians commenced to import it, and, when they became masters of the country, they tried to improve the cultivation. "Sea Island" cotton was introduced in 1872, but it did not give good results; "Upland," however, has been successful. Ferghana, well sheltered by mountains, and abundantly supplied with water, is the most important centre of cultivation. The crop of 1895 was 88,570 tons, of which 77,016 were American cotton. The Samarkand railway has supplied a necessary means of transport for the produce of Turkestan and Khorassan.

It is quite possible that cotton was introduced into eastern Africa from Arabia, where it now exists. The ancient Egyptians were certainly acquainted with it, though they made little use of it. Its cultivation in Lower Egypt, however, dates from the present century. On the other hand, cotton grows wild in all parts of tropical Africa, and there is no reason to suppose that the cultivation in the Sudan is not of native origin. The Hausa countries are noted for their cotton, and in Ethiopia considerable quantities are grown for home use. In Abyssinia cotton is cultivated in the warm zone, and to a small extent on the plateaus of the south. Also in the Zambesi country there are fields planted by the natives.

Egypt is the important cotton-exporting country. In 1821 Mehemet Ali sent for seeds to Dongola and Sennaar, and had them planted in Lower Egypt; and in 1838 a Frenchman, Jumel, introduced "Sea Island" seeds which thrived marvellously and yielded a cotton of long staple which soon obtained a widespread reputation. The production has increased rapidly, and in 1896-97 amounted to about 259,400 tons. The greater part comes from the delta where, thanks to the barrage, the rich mud of the Nile can be distributed over the fields. The seeds are planted in March, and watered during the period of high Nile by innumerable canals, and the cotton is gathered in November. Above the barrage the land available is of comparatively small extent, but the new reservoir that is to be constructed will probably increase the crop by one half.

On the discovery of America the Spaniards found cotton in use in the Antilles, Peru, and Mexico, and the Portuguese reported its existence in Brazil. At the commencement of the century Latin America supplied Europe with cotton, but cultivation has not spread there with the same rapidity as elsewhere. Brazil and Peru are now the only exporting countries. Whether the plant is indigenous in the United States is a disputed question, but certainly the first seed planted was brought from Europe at the beginning of the seventeenth century. Its cultivation spread slowly, for the great cotton-growing regions, Carolina and Georgia, were not colonised till the eighteenth century, and then only in the littoral zone, where "Sea Island" cotton was introduced in 1786. The elevated interior, the land of the "Upland" cotton, was not cultivated till after the War of Independence. The exportation rapidly increased, and from 1802 American cotton supplanted all other kinds on British markets. As the territory extended, new lands in the south were appropriated to the cotton plant, in the Mississippi States and then in Texas. The increase in the number of slaves was in direct ratio to the amount produced. From 1830 to 1840 the quantity increased by 86 per cent. The war affected the cultivation in the United States, and induced other countries to

enter the field. But the United States soon recovered their ground, and now hold the first rank among cotton-producing countries, having attained perfection in the art of cultivation and cleaning and preparing the fibre. But one of the causes of superiority is the excellent qualities of the soil. The plant may be cultivated anywhere south of 37° N. lat., but certain districts are peculiarly suited to it. First in excellence are the lands bordering immediately on the Mississippi; then the loess-covered slopes of the plateau through which the river has cut out its broad valley; and towards the east the crescent surrounding the extremity of the Alleghanies, with one end near Corinth in Mississippi, and the other beyond Montgomery in Alabama. Here there is a black soil resembling the cotton soil of India. In Texas there is another black-soil district, and, east of the Alleghanies, the Red Hills of South Carolina, and the red lands of Georgia are likewise covered with rich earth produced by the decomposition of the underlying rocks.

The development of the cultivation of cotton during the present century has been enormous. The production has risen from 1,500,000 bales to nineteen or twenty million, averaging 400 lbs. each. The United States produces on an average eleven million bales; India, three million; Egypt, one and a half; and China, perhaps, nearly as much. There remain, then, some three million bales for the rest of the world. It is worthy of remark that the cultivation has been in general displaced towards the north. It has disappeared from the West Indies, and has taken possession of the United States, the delta of Egypt, and Russian Turkestan. Previously it had spread to China, Japan, and Korea. Thus this tropical plant has come in contact with more industrious people who have made the most of it. Fibres of inferior quality tend to disappear from the European markets, and thus India is losing its European customers, finding a sale for its crop only in the extreme East.

MISCELLANEOUS.

On June 30th the Tsar decreed that the **East Cape of Siberia** should henceforth be called Cape Deshnef, after its discoverer.

The **Railway from Dyea** to the summit of the White Pass was to be finished on December 1st, and it is expected that the line will be continued to Bennett Lake by the opening of navigation in the spring.

The ashes of **Columbus** will be removed from Havana and buried with great pomp at Granada. The supposed bones of the discoverer were brought from America to Genoa in 1887 and there buried.

Mr. John Cook, M.A., F.R.S.E., has again sent us his **Meteorology of Mysore.** The records at the four stations—Bangalore, Mysore, Hassan, and Chitaldrug—have now been kept for five years, so that fair approximations to the mean values of the meteorological elements can be obtained.

The railway from Padang, **Sumatra**, to the coalfields on the Ombilien river, which has been several years under construction (see vol. viii. p. 217), is, according to the *Mouvement Géographique*, No. 45, now completed. In crossing the Barisan mountains it attains an altitude of 4200 feet, with a maximum gradient of 8 per cent.

The Suakin-Tokar-Kassala telegraph line was completed on September 22nd. Corporal Lewis, R.E., surveyed the route and superintended the construction of the line, which occupied five months. He chose the Langheb route from Tokar to Kassala, a distance of 240 miles, for a description of which see vol. xi. pp. 574 and 581.

The Danish Lieutenant, O. Olufsen, started in June for a second journey on the **Pamirs**. He intended to spend the summer in examining the Yashil-kul and Gaz-kul, and for that purpose took a portable boat. In autumn he proposed to visit Wakhan, and to spend the winter in Shignan, returning in spring to Turkestan.—*Petermanns Mitt.*, Bd. xliv. No. 10.

On November 16th an expedition organised by Mr. George Murray, of the British Museum, sailed from Gravesend in the *Oceana*. Its object is to explore the intermediate depths of the ocean. Living organisms are found in the surface waters and from the bottom of the sea up to about 60 fathoms, but on their existence in the intermediate layers there is great difference of opinion.

A vast **stalactitic cave** has been discovered in **France**, on the summit of the Deux Jumeaux. It consists of several galleries, and appears to advance far into the heart of the mountain. The bones of animals found in it, which have not yet been subjected to a scientific examination, indicate that in prehistoric times the cave was the resort of gigantic quadrupeds.—*Deutsche Rundschau*, Jahrg. xxi. Heft 2.

The Imperial Academy of Sciences in Vienna has decided to despatch an expedition to examine the extensive ruins of **South Arabia**, particularly of Hadramut, and for this purpose has secured the co-operation of the Swedish Count Landberg, who is intimately acquainted with the country and its sheiks. He will be accompanied by Dr. David H. Müller, Dr. Alfred Jahn, Professor Oskar Simony, Dr. Franz Kossmat, and Dr. Stephen Paulay.—*Deutsche Rundschau*, Jahrg. xxi. Heft 2.

The Bulu expedition has brought back information about a **dwarf people** in the *Hinterland* of **Cameroons**. Their height varies from forty-nine to sixty-three inches; some of them plainly exhibit a mixture with other races, whereby their stature has been raised. These dwarfs are said to be skilful hunters, and diligent in collecting indiarubber, which they sell to the neighbouring tribes. They dwell in families, constantly wandering about in the thick forest, and carefully avoiding much-frequented caravan routes.—*Deutsche Rundschau*, Jahrg. xxi. Heft 2.

The Servian minister at Constantinople is endeavouring to bring about the construction of a railway between the **Black Sea and the Adriatic**. Servia and Rumania have already come to an understanding regarding the work to be done in their respective territories, and the latter has commenced work on the section from Kustenje, on the Black Sea, to Turn-Severin. Servia is ready to begin its share by continuing the line to Kurshumli. It will then remain for Turkey to construct a line from Kurshumli to Scutari and S. Giovanni de Medua.— *L'Universo*, October 15th.

In the **Antarctic Number** of the *Magazine* a bibliography of the principal books and magazine articles dealing with Antarctic questions was published. It was not intended to be an exhaustive list, as such could not have been confined within a small space. Our attention has been called to three papers which were omitted. At the International Geographical Congress at Berne a paper by Dr. J. J. Wild, of the *Challenger* Expedition, and another by Mr. E. Delmar Morgan, on the "Early Discovery of Australia," were read by the latter; and at the meeting of the British Association at Cardiff, Mr. Delmar Morgan advocated a British expedition to the South Polar Seas. The two former were printed in the *Transactions* of the Berne Congress (the second also separately, at the expense of the author), and the third appeared in the *Journal* of the Manchester Geographical Society.

NEW BOOKS.

From Sphinx to Oracle—Through the Libyan Desert to the Oasis of Jupiter Ammon. By ARTHUR SILVA WHITE, Hon.F.R.S.G.S. With 56 Illustrations from Photographs by the Author and 2 Maps. London: Hurst and Blackett, Ltd., 1899. Pp. 277. *Price* 16*s.*

Mr. Silva White started from the Sphinx with the object of reaching Jarabub, but at Jupiter Ammon the Oracle said "no farther shalt thou go." Senussi oracles have an unconquerable aversion to "emissaries of civilisation." At Siwa the sheikhs were very friendly to Mr. White, and gave him greater freedom to explore the oasis than has ever been accorded to any other traveller; but, notwithstanding his dogged persistency, they were quite obdurate regarding Jarabub. No European has ever penetrated into the hallowed precincts of the stronghold of Mohammedan fanaticism; and there seems little doubt that, if Mr. White had succeeded in outwitting the precautions of the Senussi fanatics, his expedition would have entered Jarabub never to come out again. However, although Mr. White was disappointed with regard to his ultimate object, we are indebted to him for a very charming sketch of travel. In following the little caravan wending its way across the glaring sands of the Libyan Desert, we get vivid and realistic pictures of its arid vastness and overpowering monotony, of its sweeping sandstorms and scorching winds. And then by contrast we are delighted with the luxuriant vegetation of the oases, the grateful shade of the palm groves, the bright blue of the salt lakes. The descriptions of the ruined and picturesque towns call up many visions of past history. The account of Siwa and the Siwans reads like a chapter from the *Arabian Nights*. Mr. White does not profess to be an archæologist, and although he made some discoveries of antiquarian import at Jupiter Ammon, he was not aware of their full value until his return to Cairo. Nevertheless, he has been the means of disclosing an important new field of exploration, and also opened up the way for future investigators. At the present time, when the Egyptian question is a subject of study to every politician, Mr. White's account of the attitude of the Senussi in regard to the opening up of the Nile countries will be of interest. "The Senussi regard it as a meritorious act to kill a dog of a Christian, wherever he may be found; whilst all good Moslems are enjoined to expatriate themselves from countries under Christian domination." Their creed embodies a triple protest—"(1) against concessions made to Western civilisation; (2) against innovations, the result of what we call progress, in Eastern countries; and (3) against all fresh attempts made to extend Western or European influence—not exempting Turkish—in countries still preserved by the 'divine grace.'" Considering that the Senussi are said to be about three million strong in Wadai, and that northwards they are all-powerful along the whole western frontier of Egypt as far as Tripoli, it is plain that they are likely to prove a source of trouble in the near future.

The numerous illustrations from Mr. White's photographs are well chosen and very successful, although one feels that without colour it is almost impossible to convey any idea of the wonderful charm of desert landscapes. A glossary of the Arabic words and phrases occurring in the text would have been as useful as the index. In conclusion, we must congratulate Mr. White on the interest of his first expedition, and trust that we may hear more of him as an African traveller, even if Jarabub refuses to open its gates to him.

With Kitchener to Khartum. By G. W. Steevens. Seventh Edition. Edinburgh and London: W. Blackwood and Sons, 1898. Pp. 326. *Price* 6*s.*

The most successful campaign is not complete until it has found a worthy chronicler. No campaign was ever crowned with greater success than that which crushed the Dervish authority in the Egyptian Sudan, and no chronicler was better fitted than Mr. Steevens to tell the tale in an interesting, popular, racy way. Not merely did he accompany the gallant Anglo-Egyptian army as a correspondent, but with accuracy, impartiality, and vivacity he describes the whole campaign from its laborious conception to its glorious fulfilment. The small volume before us, with its luminous detail and its admirable explanatory maps, enables the reader to grasp the entire plan of action and to understand how, beginning with that splendid engineering feat, the Sudan military railway, due to the Sirdar's ingenuity and determination, the campaign ended with the battles of the Atbara, Omdurman, and Gedaref.

Military chronicles, to be successful, depend upon the ability of the author to describe military movements with power and precision, and as a specimen of Mr. Steevens' style, we select his description of the heroic charge of the 21st Lancers at Omdurman which, like the charge of the Light Brigade at Balaclava, was infinitely glorious although tactically wrong. The 21st Lancers charged what seemed to be only 300 Dervishes :—

"Knee to knee they swept on till they were but 200 yards from the enemy. Then suddenly—then in a flash—they saw the trap. Between them and the 300 there yawned suddenly a deep ravine ; out of the ravine there sprang instantly a cloud of dark heads and a brandished lightning of swords and a thunder of savage voices. Mahmoud smiled when he heard the tale in prison at Halfa, and said it was their favourite stratagem. It had succeeded. Three thousand, if there was one, to a short four hundred ; but it was too late to check now. Must go through with it now ! The blunders of British cavalry are the fertile seed of British glory. Knee to knee the Lancers whirled on. One hundred yards—fifty—knee to knee. . . . Horses plunged, blundered, recovered, fell ; Dervishes on the ground lay for the hamstringing cut ; officers pistolled them in passing over, as one drops a stone into a bucket ; troopers thrust till lances broke, then cut ; everybody went on straight through everything. And through everything clean out the other side they came."

Mr. Steevens thinks the Sirdar was a wonderfully young man (48) to hold such a command, but at Waterloo both Wellington and Napoleon were two years his juniors. In regard to style, this volume, like everything connected with Lord Kitchener's campaign, glows with energy from beginning to end, and the only blemish we would remark is the frequent use of the expression "by now," which is not good English.

Chitral: The Story of a Minor Siege. By Sir George S. Robertson, K.C.S.I. London: Methuen and Co., 1898. Pp. x + 368. With Map and Illustrations. *Price* 21*s. net.*

This well-written and deeply interesting volume gives an account of the now historical siege of Chitral, which occurred in the spring of 1895, when the author, who was British Agent, was shut up in the native fort for nearly seven weeks, with a few European officers, a detachment of the 14th Sikhs, and some troops of the Kashmir State. It forms the latest record of the heroism and resourcefulness displayed by British Indian officers when opposed by overwhelming numbers of a fierce and well-armed enemy, operating on his own ground ; and of the not less

remarkable gallantry, devotion, and endurance of our native soldiers, the great majority of whom were, in this case, men born and reared on the sultry plains of India, to whom the rigours of the snowclad passes over which their march from Gilgit led them must have been exceptionally trying.

The book is mainly, as it professes to be, a story of the siege; but in the first chapter the author gives an interesting account of the country and its people. "The dominant note of Chitral is bigness combined with desolation; vast silent mountains cloaked in eternal snow, wild glacier-born torrents, cruel precipices, and pastureless hill-sides, where the ibex and the markhor find a precarious existence." And again, "The total area of this interesting region is small. Fashioned from the ridges and spurs which run downwards from the Hindu-Kush, it lies between Kafiristán and the Amir of Kabul's other territories on the one hand, and the Gilgit frontier district, Hunza and Punial on the other. It is limited and bounded on the south by the high range which forms part of the northern watershed of the Indus. Mountain-locked and mountain-divided, its total area is a little more than that of Wales, and its population certainly does not exceed 100,000. Level ground is rare, and where it exists the soil is often swampy, or crusted with saltpetre. A great mass of mountains, traversed by three important passes, runs from the Hindu-Kush to the southern boundary range, and divides the little State into two portions."

The main lines of communication are mere hill tracts, crossing rough, untrustworthy cantilever bridges, or running over frail galleries pinned to the face of the cliff. Food is so scarce that a fat man has never yet been seen in the country. "Sensuality of the grossest kind, and murder, abominable cruelty, treachery, or violent death are never long absent from the thoughts of a people than whom none in the world are more delightful companions, or of simpler, gentler appearance." They love music and listening to narratives or fairy tales, most of which are enveloped in a "crimson atmosphere." Religious fanaticism is completely absent.

The crossing of the Shandur pass, 12,200 feet, by Colonel Kelly's force, with mountain artillery, is graphically described, and a vivid picture of the difficult nature of the country is given in the author's account of the march down the Chitral river. There are thirty-two excellent views and portraits, and five maps and plans.

Un Voyage au Laos. Par le Dr. E. Lefèvre, membre de la Mission Pavie. With 32 Illustrations and a Map. Paris: Librairie Plon, 1898. Pp. 303. *Price* 4 *frs.*

All the world knows that in 1895 a joint Anglo-French Commission went to Laos for the purpose of delimiting a buffer-state between the Shan States tributary to Burma and French territory in Annam, and that the result of the mission was the cession by our Government to France of the territory of Muong Sing. Dr. Lefèvre, a member of that Commission, now publishes a diary of his pilgrimage. He says very little about the *personnel* and work of the Commission, confining himself mainly to his own adventures, with brief notes of each day's journey, the country through which he passed, the manners, dress, and salient peculiarities of the people he encountered. Some of these notes are graphic and picturesque, some are playful and humorous; all give evidence of keen powers of observation and rapid mastery of detail. The author gives, in addition to the account of his travels with the Commission, a diary of the journeys he made independent of it. The lines of travel sketched in the diary are first from Hanoi, in Tonkin, *viâ* the Black river to Lai-chau, and thence across country to the Mekong river and the

principal towns on its banks—Chieng Hong, Muong Sing, and Luang Prabang; second, from Luang Prabang by the Mekong to Savan-Nakhek, thence overland to Hue and back by sea to Hanoi; third, from Hanoi overland by Muong Hett to Luang Prabang, where the Doctor was commissioned by his Government to found an hospital: and fourth, a series of expeditions radiating from Luang Prabang to various important stations in the states of Sip Song Panas and Sip Song Hu Thai. From the mere indication of his routes, it will be seen how large and how ethnologically interesting a tract of country Dr. Lefèvre has traversed. His jottings by the way on the scenery and inhabitants of those regions, coupled with a number of excellent illustrations, give a very fair idea of nature and life in a little-known corner of the world. An appendix on the history of Indo-China contains the author's views on the origin and succession of the different races now found in that country. He gives it as his opinion that the first inhabitants of the peninsula, the true aborigines, were the Khas, an almost savage race, without monuments and without writing, who were driven into the mountains by successive invaders of their territory. He considers the Khas to be the aborigines of the region between the Chinese frontier and Cambodia, and leaves out of account the Malay Peninsula, where, in small groups, are found two tribes, or two branches of one tribe, known locally as Sakeis and Jakkuns, much lower in the scale of civilisation than the Khas seem to be from his description of them. The Khas were disturbed in their possessions by the immigration of the Malays, who gradually succeeded in establishing themselves in several provinces, of which the most important was the kingdom of Champa, occupying the whole coast from Tourane to Baria. After the Malays came the Brahmans, banished from Benares with their chief Pra Thong. They at first fought with the Malays, and ultimately absorbed them almost completely. The Brahmans were the first ancestors of the Cambodians. Under Asoka, King of Burma, the arrival of the Khmers took place, who came from Pegu and Hangsavadi, and settled in Cambodia. Then the Tartars made incursions from the north, and upset everything. They were followed by the Thais (ancestors of the Siamese and the Laotians), who came from Mongolia or Sze-Chuan, and who spread themselves over Siam, Laos, Burmah, Quang-Li, Quang-Tung, the north of Tonkin, and the island of Hai-nan. On the east, the Annamites, hailing from Kwei-Chau, occupied the coast and all the territory between the Annamite range and the sea.

Dr. Lefèvre is aware that his theory is open to criticism, and confesses that he relies chiefly on local religious documents. These are rarely safe guides.

Au Cap Nord. Itinéraires en Norvège, Suède, Finlande. Par CHARLES RABOT. Paris: Hachette et Cie., 1898. Pp. 326. *Price* 4 *frs.*

In his preface the author states that his chief aim in this useful handbook is to "present a picture as complete as possible of the various aspects of Lapland, of the phenomena peculiar to that country, of its primitive people and its curious industries—the cod and whale fisheries. My desire has been to give information both to those interested in geography and to the tourists who visit Norway annually in increasing numbers." He accordingly conducts the reader first to the North Cape, then proceeds to the forests of Finland, and then to the Alps of Swedish Lapland and the glaciers of the North. "There," he says, "is a vast Switzerland, still completely unknown, which will afford a splendid field of exercise for Alpine climbers and a terrestrial Paradise for sportsmen."

The volume is illustrated by a poor map, whereas, in these days of cheap and excellent maps, one could have been given which would have elucidated the

handbook and made its itineraries distinct. A map of Northern Scandinavia, edited by so well-informed a traveller as M. Rabot, would have been a valuable contribution to geography.

Meine Reise in den Brasilianischen Tropen. Von THERESE PRINZESSIN VON BAYERN (TH. VON BAYER). Berlin: D. Reimer, 1897. Pp. 544. *Price* 12 *marks.*

In this important and excellently illustrated work, the Princess Therese of Bavaria narrates her travels through Brazil in 1888, her object being to investigate the tropics, to study the Indians, to collect plants, and to learn something of the zoology and ethnography of that vast region. In chapters full of botanical, geological, and zoological information, the authoress describes her voyage to Para and up the Amazon and the Rio Negro, her visit to Maranhao and Ceara, Bahia, and Rio de Janeiro, Minas Geraes, and Espirito Santo, Rio Doce, Petropolis, and São Paulo, and appends a lengthy bibliography of the leading works she consulted. A good index and a fair map of Brazil complete the record of a very conscientiously executed scientific expedition. It may be added that owing to her intimacy with the then Emperor and Empress of Brazil, the Princess enjoyed unusual facilities of observation which her own exceptional intellectual abilities turned to the best account.

A Summer on the Rockies. By Major Sir ROSE L. PRICE, Bart. London: Sampson Low and Co., 1898. Pp. x + 279. *Price* 6*s.*

This book is well described by its modest title, *A Summer on the Rockies.* It is little more than a brightly written diary of a journey by rail, wagon, and mule, partly for inspection of military posts and partly for sport. The latter consisted of shooting elk or wapiti, mountain sheep, grizzly bears, grouse, and wild ducks, and fishing for trout on and in the neighbourhood of the "Great Divide." The scenery was magnificent—a combination of lofty precipices, wild gorges, and beautiful park-lands. An interesting description is given of the Yellowstone National Park, but as it has been so often visited, Sir Rose Price has not much that is new to tell. One remarkable thing he notes is the punctuality of some of the geyser eruptions. "Old Faithful," in particular, throws a column of boiling water two feet in diameter to a height of one hundred and fifty feet with the utmost regularity every sixty-three minutes night and day. Major Price was favourably impressed with the efficiency of the United States regular soldier and his treatment by the State, and suggests some lessons for ourselves in this connection. Had he written now, his opinion might have been somewhat modified.

Eine Reise nach dem Ural. Vortrag gehalten im Wissenschaftl. Club in Wien am 9 December 1897, von Oberbergrath Dr. E. TIETZE. Wien: Verlag von Ad. Holzhausen, 1898.

In the above lecture the author gives the result of his experiences during the excursion to the Urals, organised by the Russian Government, just before the opening of the International Geological Congress, held at St. Petersburg in 1897. The first scientific exploration of this range of mountains was made by Pallas in the latter half of the last century, between 1768 and 1774. Then he was followed by Humboldt, Rose, Murchison, and others. The titles of the works referred to by Dr. Tietze are useful, and many of his remarks on the flora as well as on the

geological structure are interesting and instructive. For instance, the mollifying influence of the Atlantic is known to penetrate as far as the Urals, but no farther, and consequently the climate of Western Siberia is much more rigorous than that of Europe. Hence the oak and the hazel, which have much the same extension, only reach the western buttresses of the Ural chain. As a forest tree, the lime only crosses the mountains at the extreme south. The ash, maple, and elm are either wanting or confined, where they do grow, to the western slopes of the chain.

Canada and its Capital, with Sketches of Political and Social Life at Ottawa. By the Hon. J. D. Edgar, Q.C., M.P., the Speaker, Commons of Canada. Toronto: G. N. Morang, 1898. Pp. 217. *Price* $2.50.

In 1858 Her Majesty selected Ottawa as the site of the Canadian capital, and in 1860 the Prince of Wales laid the foundation-stone of the magnificent Parliament Buildings there. As Sir James Edgar (now K.C.M.G.) is Speaker of the Dominion House of Commons, he has unrivalled opportunities of studying the details of Canadian parliamentary institutions. One of these will interest British ladies. "The Canadian woman is not caged in behind bars after the cruel example of her Westminster prototype, but she has equal rights in all places where men may go." They have also at Ottawa a system of pages which our British legislators might envy. "If a member in his place wishes to mail a letter, get a book from the library, a glass of water, or a new pen, he snaps his fingers, and a little page, neatly clad in Eton jacket and dark clothes, flies to do his bidding. There are some twenty of these little chaps, and half of them are in attendance in the chamber night and day."

Beautifully illustrated, the volume has a wide range, from biographies of leading Canadian statesmen like Sir Wilfred Laurier, Sir Charles Tupper, and Sir Richard Cartwright, to Ottawa summer and winter sports, trout-fishing, and adventures with moose. Enthusiastically loyal to Britain, the author declares that if the Canadians "were seeking for an ally, there is none to choose so free, so paramount in commerce, so great in literature, so full of generous and world-wide sympathies for human progress and liberty, as the great Mother of Parliaments that is calling to them from over the sea."

Twelve Hundred Miles on the Murray River. By A. S. Murray. With Facsimile Illustrations in colours by the Author. London: J. S. Virtue and Co., Ltd. Australia: George Robertson and Co., 1898. Pp. 36. *Price* 42*s.*

The Murray river has its charms, its phases of beauty, and even of grandeur: but nevertheless there is a great sameness about it, a "eucalyptine" monotony peculiar to Australia—long stretches of water slowly creeping between low banks and plains more or less wooded with gum-trees. The present work aims at a representation of the typical characteristics of the river. It contains fifteen of the author's water-colour sketches, very well reproduced by chromo-lithography, but for artistic effect and colour they are mostly dependent on their skies. Geographically they are of interest as showing the scenery of the river banks before the settler has cut down the timber and otherwise interfered with virgin nature. The text is sketchy, and gives an interesting account of the journey of the author and his friend in an open boat from Echuca to the sea. Along the route he notes leading features of interest—geology, flora, bird life, fishing, farm colonies, and aborigines.

Memoirs of Alexander Gardner, Colonel of Artillery in the service of Maharajah Ranjit Singh. Edited by Major Hugh Pearse. Edinburgh and London: William Blackwood and Sons, 1898. Pp. xxxiv + 359. *Price* 15*s.*

The story of the adventurous career of Colonel Gardner, as related by himself and Major Pearse, is one which fascinates and entrances the reader. Of Scottish origin, but born in America, he, at the age of twenty-seven, resolved to seek for fortune in Central Asia in the Russian service; but soon realising that nothing was to be hoped for from it, he determined to make for the Court of Persia. From this time his adventures began; and nothing more romantic, nothing more exciting can be desired than the story of his life among the wild tribes of the Hindu Kush. He depicts with an accurate, graphic, and truthful pen a state of society which, even now, with all that we know of Eastern life, it is hard to realise as in no way exaggerated. Intermixed with the story of universal treachery and cruelty, rapine and murder, is the history of his own career, which perhaps is the most remarkable, as it is the most interesting, part of the book. He was eminently a soldier, but besides this he proved himself to be a diplomatist of the highest skill and courage in a country where duplicity, statecraft in its worst sense, and chicanery were universal, where no man's life was safe, and where the bonds of religion and relationship were of no avail against selfishness or self-aggrandisement. It fell to his lot to enter the service of the famous "Lion of the Punjab," Ranjit Singh, and he shared in, and contributed to, some of his greatest victories. He was an eye-witness of, and an active participator in, the awful scenes of bloodshed and anarchy which ensued on the death of Ranjit. Grievously wounded time after time, plunged into dismal dungeons, in danger of death sometimes by starvation and oftener by bullets or by daggers, Colonel Gardner survived all and lived till the patriarchal age of ninety-two, spending the last years of his life in peace in the lovely valley of Cashmere.

It is quite certain that, in the course of his wanderings and adventures beyond the north-west frontier of India, he traversed lands which, up to his time, had never been trodden by an Englishman. For example, he was the first Englishman to cross over Kafiristan and to enter Chitral, and so anticipated the expedition of Sir George Robertson. Most unfortunately for the cause of Geography, the journals and notes in which his impressions and observations of this part of his travels were recorded have been irretrievably lost. The part of his diary which refers to his travels in Kafiristan was confided to the ill-fated Sir Alexander Burnes and disappeared. It is practically certain it was destroyed with the rest of Sir Alexander's property when he was treacherously murdered at Kabul. Part of the story of Gardner's travels was published in the *Asiatic Journal* in 1853, but so badly arranged and misprinted that serious doubts were raised as to whether he had ever been over the ground he undertook to describe. But all doubts on this point have been dispelled by recent investigation, and such distinguished geographers as Sir Henry Rawlinson, Sir Henry Yule, and Mr. Ney Elias agree in acquitting Colonel Gardner of any deliberate untruthfulness "and in believing that Gardner had verily and indeed traversed Badakshan and the Pamirs and had found his way from these regions to India by the way of Gilgit and Chitral." Colonel Gardner undoubtedly watched with an interested and distrustful eye the advance of the Russians to the East, and pointed out that an attack on Afghanistan through Chitral was quite feasible and therefore probable. In 1825 he visited the famous ruby mines of the Shughnan valley, but he was much less interested with them than with the beauty of the Kafiristan women. He declares it to be proverbial; "hair varying from the deepest auburn to the brightest golden tints,

blue eyes, lithe figures, fine white teeth, cherry lips, and the loveliest peach-blossom on their cheeks."

Major Pearse, in his treatment of the materials at his disposal, has shown himself a capable and judicious editor; and Sir Richard Temple, some part of whose service was in the Punjab, has contributed a suitable and appreciative introduction.

Linguistic and Oriental Essays, Written from the Year 1840 to 1897. Fifth Series. By Robert Needham Cust, LL.D. 2 vols. London: Luzac and Co., 1898. Pp. xiv+vii+1075. *Price* 30*s.*

For sixty years Dr. R. N. Cust, long a distinguished member of the Indian Civil Service, and honorary secretary of the Royal Asiatic Society, has written and published articles and essays on India and Africa, missions Protestant and Roman, the Bible, the world-religions and languages, and some lighter themes. In Trübner's Oriental Series his more elaborate and scholarly researches on India and Africa appeared from time to time. Now, on his seventy-seventh birthday, he has gathered up the fragments that remain from the twelve hundred publications which he has written, and has given them to the world as a fifth series, covering 1075 pages. If only he had supplied an index! But the venerable publicist has given us a portrait of himself, as frontispiece—*sic sedebat*. As an honorary graduate of the University of Edinburgh he is an adopted son of Scotland. We welcome, therefore, this renewed evidence of his genial erudition, his shrewd common sense, and his devotion to the highest good of the dark races intrusted to our Empire. If almost every one of those multitudinous papers and essays provokes us to differ somewhat from the writer, all are the more suggestive, while all form a testimony to his self-denying spirit and nobility of aim. We thank him, especially for the last of the series, "A Chapter in the History of the Conquest of the Punjab," being his journal in 1846, when, at the age of twenty-four, after the battle of Sobraon, he became assistant successively to George Broadfoot, Frederick Currie, Henry Lawrence, and then to his great master, John Lawrence.

Die Kolonialpolitik Grossbritanniens. Erster Theil. Von den Anfangen bis zum Abfall der Vereinigten Staaten. Von Dr. Alfred Zimmermann. Berlin: Mittler und Sohn, 1898. Pp. 475. Bibliography and three Maps. *Price* 10 *marks.*

Last year we were glad to review favourably Dr. Zimmermann's work on the Spanish and Portugese colonies, and we have now the pleasure of calling attention to the first part of his work upon Great Britain's colonial experiences, from their commencement until the loss of the United States. This volume shows us under what conditions a colony best ripens, and what spirit must animate a people which wishes to found a healthy colonial empire. It describes the methods which Britain adopted, the faults which the author considers she has made, and the results she has attained. And he has sought to picture the men who founded our colonial empire, and to remove many erroneous ideas connected with them which appear to be common in Germany. Dr. Zimmermann has attempted to write without prejudice, and we are glad to be able to say that he has well accomplished his purpose, and has given us a thoroughly unbiassed account of a subject which will doubtless be of great interest to British readers, as well as to those for whom he has specially written.

In considering the book as a whole, we notice that Dr. Zimmermann possesses a good perspective view of this great subject, and has balanced his work with marked success. He has successfully compressed a great amount of information

concisely yet clearly, and, as we read his pages, we fully recognise the amount of research he has expended upon his work and the successful grasp of its intricacies. A detailed review of this volume is not necessary, but we can thoroughly recommend it to our readers.

Western Civilisation in its Economic Aspect: Ancient Times. ("Cambridge Historical Series.") By W. Cunningham, D.D., LL.D. Cambridge: University Press, 1898. Pp. xii + 220. With four Maps and a Chronological Chart. *Price*, 4*s.* 6*d.*

Dr. Cunningham's object is to trace the building-up of the economic system of the ancient world, and to assign to each of the main contributory agencies—Egyptian, Phœnician, Greek, and Roman—its due share in the work of initiation and diffusion. However hard to trace, there has been a certain continuity of civilisation—itself a process rather than an end. In the earliest times there were several civilisations, co-existent, yet existing in isolation. Dr. Cunningham's inquiry begins with Egypt. The most striking feature in its history is its "extraordinary duration"; a nation, in fact, if organised within on a basis at all stable, had an opportunity of perpetuating its greatness and power in early times, when the march of events was rapid and sudden only for the unstable. As more distinctive marks of Egyptian civilisation, Dr. Cunningham assigns the territorial (non-maritime) character of the empire, and the absence of any constant inter-action of economic and political conditions, such as is found in later civilisations: "in ancient Egypt political power directly dominated economic life" (p. 38); "industrial organisation was a form of prison life, or a method of taxation." Egypt was practically excluded from commerce by its situation, whereas the people of Israel could not escape commerce (p. 46). The influence of Israel, short-lived as empire, is that of a race dispersed, with habits and characteristics formed in Palestine under Solomon. In the discussion of the conditions of the earliest civilisations, Egyptian particularly, one could have wished for a more sympathetic insight and appreciation than Dr. Cunningham has ventured upon in his rigid, over-exact view of his theme. Phœnician history—next considered—is suggestive both in success and in failure. The strength of Phœnicia lay in commerce, as from 1028 to 814 B.C.; its weakness in the want of political cohesion and of adequate provision for defence, whether by sea or by land. The basis was not securely laid; its basis was the fluctuating basis of trade, better in forming than in keeping an empire, imperfect in each function. Wealth did not bring substantial power: and the motive of beneficent exercise of power was lacking. As maritime pioneers and as colonisers the Phœnicians did their best work. The superiority of the Greek over the Phœnician is as the superiority of mind over matter; not mere material prosperity, but individual self-development and political greatness, resting upon and inseparable from the individual, become ends of the State and motives of action. This furnishes Dr. Cunningham with his thesis: "the history of Greek economic development gives us in a nutshell, as it were, the history of the world" (p. 137); "we find, in investigating the origins of our varied life in modern Christendom, that all lines of inquiry take us back to Greece" (p. 139); and so, in the last words of this book and elsewhere, Rome is appreciated mainly as she diffuses and perpetuates Greek civilisation (pp. 141, 209, etc.); and what ought to have been the strongest part of the work thus becomes the least satisfactory. The result is a certain inconsistency—subordination of Rome to Greece, and yet recognition of the establishment by Rome of those conditions which "afford the best opportunity for economic progress" (p. 154), and which gave to her empire "an extraordinary

permanence, and enabled it to exercise the most marvellous influence on the destinies of the world" (p. 169). The *pax Romana* must be viewed comprehensively (generously it need not be) or not at all; and Dr. Cunningham has experienced, and has not overcome, the difficulty of detaching economic progress from broad political conditions and development, of which the economic are but a part. Rome's work was that of real and lasting endeavour and performance, and not merely of mind and of promise. As of especial bearing upon Dr. Cunningham's subject, the economic problem and crisis of Rome might have been more clearly led up to and more clearly examined: Rome's corn-law system, bad as corn-law and bad as poor-law, bad for Rome and for her empire; directly and indirectly, *latifundia perdidere Italiam.*

It is superfluous to commend a work by Dr. Cunningham on a subject which (limitation of times notwithstanding) he has made pre-eminently his own. Few men in this country could have written as good a book as this; none, perhaps, a better. Concise, learned and suggestive, it will serve a most useful purpose in supplementing the accepted text-books on ancient history, and in helping students to co-ordinate their ideas on the history of ancient times.

North America. Vol. II.—The United States. By HENRY GANNETT, Chief Geographer of the United States Geographical Survey. (Stanford's Compendium of Geography and Travel.) London: Edward Stanford, 1898. Pp. 466. *Price* 15*s.*

A wise selection has been made in the choice of an author for this volume of the *Compendium.* Mr. Gannett has an intimate knowledge of his country, and is in a position to obtain the fullest information on those subjects which he may not have investigated personally.

The section entitled General View of the Continent (by which is meant the United States Territory) seems to us rather too brief for a geographical book; we should have expected more detailed descriptions of many parts, as, for instance, the basin of the Great Lakes, Florida, the great Californian Valley, etc. And much the same may be said of the surface geology. On mining, population, social condition of the people, the great cities, etc., the information is varied and full of detail, for statistics are Mr. Gannett's strong point. Throughout the work his treatment of his subject is more or less anthropocentric; in the topographical section he describes at length the grand scenery of the Colorado, the Yellowstone Park, and the Yosemite Valley, often giving directions for reaching the districts most attractive to tourists; under geology he devotes a large space to the valuable products of the earth, and their exploitation; the Indians and Negroes, native Whites and immigrants, and their social conditions, the agriculture, government, commerce, and industries of the United States receive a large share of attention, and a short history of the rise of the colonies and the chief political events since the Declaration of Independence is also added.

Like the other volumes of the series, the present one is well provided with good maps and illustrations.

An Illustrated School Geography. By ANDREW J. HERBERTSON, F.R.S.E., F.R.G.S. London: Edward Arnold, 1898. Pp. 263. *Price* 5*s.*

Dr. Herbertson has adopted the form of Frye's *Complete Geography,* which enables maps of a useful size to be bound up with the text, and has also made use of most of the illustrations. In plan also Dr. Herbertson's book is similar, being a description of the physical features, fauna, flora, etc., of the countries of the

world, and an explanation of natural phenomena, and not a mere collection of names and statistics. Otherwise the text in the new work is very different: the various sections have been extended, condensed, or modified, and the chief place is given to Great Britain. The physiographic introduction has been enlarged, and with the aid of new illustrations such phenomena as the seasons, day and night, etc., are clearly explained. We may, perhaps, also make special mention of the chapter on the distribution of plants and animals. The various conditions controlling plant life are well explained, and the distribution of plants according to temperature and, hence, vertically and horizontally, and the flora of savannahs, tundras, etc., is described. The fauna in each realm is noticed, and the denizens of the above forms of land surface are separately enumerated. The maps are good and well chosen, and some new illustrations are added. The form will probably be an obstacle to the general adoption of the book in schools, though it is only the size of a rather thick school atlas. Should this be so, it will be much to be regretted, for from this book the pupil can gain an intelligent idea of the world he lives in, and how men live in it.

Revised Text-Book of Geology. By JAMES D. DANA, LL.D. Fifth edition. Revised and enlarged. Edited by WILLIAM NORTH RICE, Ph.D., LL.D. New York, etc.: American Book Company, 1897. Pp. 482.

At the request of the late Professor Dana's family Professor Rice has completed the revision of this excellent work, and has entirely rewritten the closing chapter, in which the general bearing of palæontology upon evolution is discussed. The treatment of metamorphism has also been considerably modified, especially with reference to dynamic metamorphism and the development of a foliated structure in igneous rocks.

From a geographical point of view, we are glad to see the obscure but fascinating subject of River Terracing adequately treated in this work instead of being slurred over as in too many geological manuals. The volume is clearly printed and well illustrated, and being also of a handy form can thoroughly be recommended to students as a book which (in its Editor's words) "will keep before their minds the name and the scientific work of one of the greatest of geologists and one of the noblest of men."

Natural Advanced Geography. By JACQUES W. REDWAY, F.R.G.S., and RUSSELL HINMAN. With Illustrations and Maps. New York, Cincinnati, Chicago: American Book Company, 1898. Pp. 160.

This is the latest, and it may also be pronounced the best, of the American type of school geographies, inasmuch as it combines nearly all the best features of its forerunners. The first section of the book treats of the earth as a whole, and of the general manner in which its physical features, its plants, its animals, and its human inhabitants have reached their present condition and distribution through centuries of change and development. This part leaves little to be desired. It is well considered, well put together, and fully illustrated. The remainder of the book is devoted to the various countries of the earth, the development of each part being studied in the light of the preceding lessons on the earth as a whole. So far as it goes, this method of treatment, aided by maps and ample illustration, is ably carried out. The description of the United States is admirable, and very complete, but the space devoted to the other countries of the world is altogether inadequate. Considering that this professes to be an advanced text-book, surely the geography of the British Isles is entitled to more than a single page, while half the book is devoted to the United States!

Report of the Chief of the Weather Bureau, 1896-97. U.S. Department of Agriculture. Washington, 1897. Pp. x + 431. Charts 33. Plates 71.

Besides the ordinary monthly and annual summaries of observations for the year 1896, the new report of Professor W. L. Moore, chief of the U.S. Weather Bureau, contains many valuable papers, tables, and maps, giving a more accurate account of the climatology of the United States than has hitherto been published. Annual maps of mean temperature, pressure, rainfall, cloudiness, and relative humidity are given, and January and July mean pressures, as well as the mean temperature and mean precipitation for each of the twelve months. Maps of the rainfall of special wet months, and of departures from the normal then experienced, and the resulting hydrographical curves for different rivers are published, and yield interesting material for the study of river floods, six of which are discussed in the text, the latest destructive one of the spring of 1897 (a map of which was published in this *Magazine*, vol. xiii. p. 419, 1897) being very fully treated.

There is one point about which we should like to have more precise particulars —the basis of the values used for the reduction of temperature for altitude. The values adopted are for the winter months, 1·5° F. for those of spring and autumn, and for the year 2° F., and for the summer months 2·5° F. per 1000 feet. We venture to think these values all far too low, and a comparison with the figures in Professor Supan's *Physische Erdkunde*, new edition, p. 56, bears this out. This affects the trend not merely of the isotherms but also of the isobars, as a comparison of Dr. Buchan's *Report on Atmospheric Circulation* ("*Challenger*" *Reports*), or Dr. Hann's *Atlas der Meteorologie*, clearly shows.

Robert Louis Stevenson. By MARGARET MOYES BLACK. ("Famous Scots Series.") Edinburgh and London: Oliphant, Anderson, and Ferrier, N.D. Pp. 159.

Though Mr. Sydney Colvin is preparing a *Life* of Stevenson, there is room for a condensed biography. The present work is of suitable length, but in other respects is hardly satisfactory. Too much space is devoted to trivialities, while much that the reader would like to know is barely touched upon.

It is strange that portraits are not published in this series.

On the Distribution of Rain over the British Isles during the Year 1897. Compiled by G. J. SYMONS, F.R.S., etc., and H. SOWERBY WALLIS, F.R.Met.Soc., etc. London: Edward Stanford, 1898. Pp. 239. *Price* 10*s*.

This important work has this year been brought out earlier than usual. It contains the records of an increased number of observers, over three thousand in all, but Mr. Symons states that more correspondents are needed, especially in Scotland. Besides the usual tables, monthly notes, and other remarks on the peculiarities of the rainfall of the year, there are tables of evaporation at Croydon, by Mr. Baldwin Latham, and an article on the Mean Annual Rainfall in the English Lake District.

Die Ostafrikanischen Inseln. Von Prof. Dr. C. KELLER. Berlin: Schall und Grund, 1898. Pp. 188. Many Maps and Illustrations.

Twelve years ago Professor Keller visited the Seychelles, Madagascar, and other East African islands, and he has written this brochure, which forms the second volume of the "Bibliotek der Länderkunde," edited by Messrs. Kirchhoff und Fitzner. Whilst it cannot be said that the author has given an exhaustive account of the islands in the Indian Ocean, he has yet given an accurate picture of

their main characteristics, and he has utilised information obtained from many writers on those points which had not come under his special observation. The maps and illustrations are excellent, and the book can be recommended to those who want a brief *résumé* of the knowledge available on the subject.

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band iv. Jahrgang, 1895. Berlin: W. H. Kühl, 1898. Pp. xvi + 411.

The present volume is compiled with the usual care, and forms a very complete bibliography for the year. It would be an advantage if the book could be brought out earlier, but the large number of entries necessitates a vast amount of work, and even now some publications could not be included owing to delay in publication of certain lists. The example of the *Annales de Géographie* in appointing co-operators in each country might be followed with advantage.

Annales de Géographie. Bibliographie de 1897. Pp. 296.

The seventh annual issue of the *Bibliographie* is as complete as the preceding numbers, and the abstracts and critical notes accompanying most of the entries are useful as a guide to the student and contain a large amount of valuable information.

Grant Allen's Historical Guides. Venice. London: Grant Richards, 1898. Pp. 270. *Price* 3*s.* 6*d. net.*

Mr. Grant Allen's guides excel in their original observations. Thus he reminds us that the present railway entrance to Venice is entering Venice by the back door. "The front door was designed for those who came by sea; there, Venice laid herself out to receive them with fitting splendour." Again, he begs tourists to remember that originally (save for the accident of language) "Venice was rather a Greek than an Italian city." Consequently tourists should first familiarise themselves with Byzantine Venice, and then trace the gradual encroachment of Gothic art, and then the Renaissance movement. Most of the sights of Venice are well done, but the very interesting cathedral of Torcello is rather scamped.

Saunterings in Florence. By E. Grifi. London: T. Fisher Unwin, 1898. Second Revised Edition. Pp. 501.

In the course of ten "walks" the authoress of this most excellent Guide introduces us to all the places of interest in and around Florence. As a handbook the work is singularly complete and evinces great skill, care, and study. The illustrations are numerous and attractive, and the book is one whose contents every visitor to Florence ought to master if he wishes to understand and appreciate that celebrated city.

Paris and Environs, with Routes from London to Paris. Handbook for Travellers. By Karl Baedeker. Leipzig: Karl Baedeker, 1898. Pp. xlvi + 428. *Price* 6*s.*

The new edition, the thirteenth, is very similar to the preceding. The maps, plans, etc., are the same in number, but contain a few additions, such as the plan of the Exhibition of 1900. The text has been slightly extended here and there, but the book is rather smaller, the paper being thinner.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Fourteenth Session, 1897-98.

The Council has the honour to submit the following Report :—

Membership.

The changes in the number of members have been as follows :

Number on 1st November 1897,		1598
New members added,		119
		1717
Deduct by Deaths,	29	
,, Resignations,	75	
		104
Number remaining on 31st October 1898,		1613

This represents a net increase of 15 members over the number of last year, which was the highest previously recorded.

Of the present members, 911 are on the Edinburgh list, 314 on the Glasgow list, and 113 and 104 on the Dundee and Aberdeen lists respectively ; in addition to these, 171 members reside in England or abroad. The Glasgow and Dundee Branches have increased their membership by 1 and by 4 respectively, while the Aberdeen Branch has decreased by 3 members.

Diplomas of Fellowship.

The Council has conferred the Ordinary Diploma of Fellowship on the undermentioned members of the Society who had complied with the conditions laid down in the Laws, viz. :—Thomas Frame Thomson, C.E., A.M.I.C.E. ; William Speirs Bruce ; Mrs. Fanny B. Workman ; William Coldstream ; His Excellency Sir James S. Hay, K.C.M.G. ; William Lindsay ; William Jeffrey ; Rev. Hugh Callan, M.A.

Finance.

The Council submits the annexed Financial Statement, which shows that the Funds have been increased during the Session by £148, 9s. 2d.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 30th October 1897 to 31st October 1898.

FUNDS AT CLOSE OF LAST ACCOUNT: —			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,		301 9 10	
		£1900 11 7	
Balances due by Bank of Scotland on Accounts Current at Edinburgh, £194, 15s. 10d.; at Glasgow, £25, 2s. 4d.,	£219 18 2		
Balance due by Honorary Treasurer, £46, 0s. 11d.; and by Secretary, £4, 10s. 8d.	50 11 7	270 9 9	
		£2171 1 4	
ORDINARY SUBSCRIPTIONS, including Life Members,	£1544 11 0		
DIPLOMA Qualification Fees,	2 2 0		
FEES received for Society's Diploma—7 at £1, 1s.,	7 7 0		
LECTURE TICKETS sold,	32 9 3		
MAGAZINES sold,	61 10 9		
DIVIDENDS and INTERESTS,	68 6 11		
MISCELLANEOUS,	3 0 0	1719 6 11	
		£3890 8 3	

MAGAZINES, Printing, Paper, Lithographing, etc., from Nos. 9 to 12 of Vol. XIII., and Nos. 1 to 8 of Vol. XIV., all inclusive, and for Postages, Delivery, etc.,		£647 3 6	
Less—Received during the year for Advertising,		60 0 0	
		£587 3 6	
GENERAL PRINTING,		25 14 8	
BOOKS and other Furnishings for Library,		25 19 6	
RENT OF HALLS, and other expenses of Lectures,		220 2 6	
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,		126 17 6	
SALARIES: —			
To *Secretary*, to 15th October 1898,	£200 0 0		
,, *Librarian and Clerks*,	272 0 0	472 0 6	
MISCELLANEOUS, including Stationery, General Expenses, Advertising, Cleaning, Postages, Office Furnishings, Expenses at Glasgow Branch,		106 6 1	
MEDAL FUND,		6 14 0	
		£1570 17 9	
FUNDS AT CLOSE OF THIS ACCOUNT:			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,	£1102 19 9		
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,	496 2 0		
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,	301 9 10		
	£1900 11 7		
Balances due by Bank of Scotland: —			
On Deposit Receipt,	£200 0 0		
On Accounts Current — At Edinburgh, £177, 8s. 10d.; at Glasgow, £1, 1s.	178 9 10		
	£378 9 10		
Balance due by Honorary Treasurer, £34, 11s. 2d.; and by Secretary, £5, 17s. 11d.,	40 9 1	418 18 11	
		2319 10 6	
		£3890 8 3	

Edinburgh, 17th November 1898.—I have examined the Accounts of the Royal Scottish Geographical Society, for the year ending 31st October 1898, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

HUGH BLAIR, C.A.

Meetings.

The Society held 27 meetings, of which 13 were in Edinburgh, 6 in Glasgow, 4 in Dundee, and 4 in Aberdeen. These meetings were addressed by Mrs. I. L. Bishop, F.R.S.G.S.; Mr. Alfred E. Pease, M.P.; Dr. Sven Hedin; Lieut R. E. Peary, U.S.N.; Mr. A. J. M'Millan; Hon. David W. Carnegie; Dr. James A. Greig; Rev. Hugh Callan; Mr. C. E. Borchgrevink; Mr. William Ogilvie; Prof. Patrick Geddes; Mr. Harry de Windt; Major Stanley Paterson; and Colonel Sir Howard Vincent, C.B., M.P.

The Society's Magazine.

The *Scottish Geographical Magazine* has appeared, as usual, every month during the session. In October, a special Antarctic number was issued with the object of enlisting public sympathy and assistance in a British Antarctic expedition.

The Council desires to acknowledge its obligations to contributors of articles, as well as to the following gentlemen who have ably assisted the editors:—The Hon. J. Abercromby; J. G. Bartholomew; J. T. Bealby; George Bickerton; W. B. Blaikie; J. W. Brodie-Innes; H. M. Cadell; C. G. Cash; Sir David P. Chalmers; Dr. Th. Delius; Dr. Felkin; H. B. Finlay; Professor P. Geddes; J. G. Goodchild; Gilbert Goudie; Dr. A. J. Herbertson; Professor C. G. Knott; Dr. J. W. M'Crindle; Professor G. W. Prothero; A. J. Ramsay; J. R. Reid; Rev. G. M. Reith; Ralph Richardson; Colonel Sconce; Rev. S. J. Ramsay Sibbald; J. Y. Simpson; Dr. George Smith; Robert Smith; J. Arthur Thomson; Colonel P. D. Trotter, and W. B. Wilson.

Library and Map Department.

During the past session 253 books, 20 atlases, and 200 map-sheets have been added to the Library. Three new exchanges have been arranged. The number of volumes borrowed by members was fully 1800. As usual, the Library has been frequently visited by members and others in search of information. The expenses of the Library, including cost of binding, amounted to £25, 19s. 6d.

The Council desires to record its thanks to Foreign and Colonial Governments for the official publications presented to the Library, and also to private donors, among whom may be mentioned the following:—Mrs. Hugh Rose; Colonel Aytoun; Rev. Professor Garden Blaikie; Mr. J. Y. Buchanan; Dr. Leonard Dobbin; and Mr. Coutts Trotter. Its thanks are also due to the Corresponding Members of the Society and others who have presented books and pamphlets to the Library, and to Mr. J. P. Thomson, F.R.S.G.S., Major A. C. Yate and others for contributions to the Society's collection of photographs.

The Society's Rooms were closed during the month of August for cleaning.

The Society's Branches.

The Council acknowledges with pleasure the services rendered by the Honorary Officials of the Society's Branches at Glasgow, Dundee, and Aberdeen.

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